News about

B.F.Goodrich Chemical *raw materials*

Time to protect against scorching... and protect production with GOOD-RITE VULTROL

You can prepare in advance for uninterrupted summer production by stocking up on Good-rite Vultrol. By retarding cure at processing temperatures, Good-rite Vultrol prevents scorching all year 'round—but especially in summer. It serves as a mild activator at curing temperatures—and makes possible remarkable savings in recovery of scorched stock.

Good-rite Vultrol is beneficial in the processing of highly loaded or highly accelerated compounds, too. It is particularly effective with high furnace blacks for tire tread compounds.

No special handling is required. Good-rite Vultrol is supplied as a free-flowing flake, economical and easy to use. For more information, write Dept. FA-5, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich

GEON vinyls • HYCAR rubber and latex
GOOD-RITE chemicals and plasticizers

Good-rite CHEMICALS

*See our catalog in Sweet's Product Design File.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

THESE THREE NEW REGAL BLACKS

CABOT
REGAL

made by an entirely new process*, will give you new ideas about what carbon black can do for rubber.....

REGAL® 300

— this new oil furnace black is recommended as a lower cost replacement for channel black in rubber applications. Provides rubber properties virtually identical with those of premium priced channel blacks, but with the faster curing rate of HAF types. ■ Comparable with EPC black in modulus, elongation and tensile strength, Regal 300 has actually outperformed channel blacks in wear and tear resistance, cracking and chipping, in passenger car tire and truck tire road tests. ■ Recommended for highway, off-the-road truck and passenger car tire treads, and tread rubber, where service calls for typical channel black resistance to tearing, cutting and chipping.

REGAL® 600

— this is a totally new type of oil furnace black for passenger car tire treads and tread rubber, which combines low hardness and low modulus (for quieter ride and better traction), with the excellent tread wear resistance of an ISAF black. ■ It outperforms ISAF black in cold SBR, oil-extended SBR and natural rubber by delivering higher tensile strength and elongation, lower modulus and hardness, and lower heat generation.

REGAL® SRF

— this is the first semi-reinforcing furnace black to be made from oil. Performance matches and in some cases excels conventional gas-produced SRF black. ■ Interchangeable with gas-produced SRF, Regal SRF has the same physical properties and processing characteristics — equivalent modulus, hardness, tensile strength, elongation, tear resistance, resilience and compression set — in natural rubber, SBR, butyl, neoprene and nitrile rubber.

For complete information, write:

CABOT

GODFREY L. CABOT, INC.
125 HIGH STREET, BOSTON 10, MASSACHUSETTS

* These 3 new Regal blacks, developed by Cabot research and produced by a new, exclusive manufacturing process from oil, are now in commercial production and available world-wide — another step in Cabot's long-range program to meet threatened gas shortages and rising natural gas prices.

Rubber Age

COVERING THE MANUFACTURE OF RUBBER AND RUBBERLIKE PLASTICS PRODUCTS

MAY, 1960 VOL. 87, NO. 2

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* Appears every other month

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Highlights Sidelights *of the News . . .*

May, 1960

The government has filed suit to break up the merger of the Aluminum Co. of America and the Rome Cable Corp. on charges that the merger violates the Clayton Anti-Trust Law by hindering competition in wire and cable production . . . The complaint seeks a court order to force Alcoa to rid itself of all Rome assets and asks for an injunction to keep the companies from further intermingling their operations (page 293).

A $2 million modernization program, largest in the company's history, has been announced by Seiberling . . . The program, to be concentrated at the Barberton, Ohio, plant, brings to a total of nearly $3.5 million the cost of the company's current expansion and improvement program (page 300).

Rohm & Haas has purchased from the U.S. government the idle butadiene plant at Louisville, Ky., for $6,100,000 . . . The firm plans to use the 139 acre site as a location for a new plant to manufacture products already made by the company . . . Company officials point out that Rohm & Haas has no plans for going into the rubber business (page 303).

As a service to the rubber industry and its suppliers, this issue of RUBBER AGE contains a listing of those plants which have announced vacation schedules during which time plants will be closed or operations curtailed (page 312).

A 1960 world-wide capital expenditure program of $90 million, largest in the company's history, has been announced by Goodyear . . . The current investment plan will bring to a total of $440 million Goodyear's 1955-60 capital investment expenditures (page 320).

Two new synthetic rubber manufacturing plants are expected to raise French production of synthetic rubber to 80,000 long tons annually . . . This amount will exceed French domestic requirements by some 20,000 long tons (page 324).

Production facilities of Firestone are being expanded by a $120 million construction and modernization program . . . The world-wide program includes two new tire plants, one at Calgary, Alberta, Canada, and the other at Bethune, France (page 326).

NOTICE ANYTHING NEW ABOUT THIS ISSUE?

The news section of RUBBER AGE, heretofore set in an 8 point type face now appears in a 9 point face . . . This will make for easier reading and is but another step in our efforts to make this journal not only the most informative but the most modern!

Calcined

Polyfil 40, 70 and 80

reduced percentage of water of hydration; many uses such as electrical insulation and in light-colored calendered, molded and extruded PVC and rubber compounds

Water fractionated

Polyfil C, X and F

very easy processing; light color; fine particle (also available as Polyfils XB and FB in spray-dried form)

Aerfloted

Suprex—High reinforcement...*LGB*—very low grit, high reinforcement...

Paragon—easy processing...*LGP*—very low grit, easy processing...

Hi-White R—white color

ALL GRADES FOR ALL NEEDS

Write for technical service bulletins on any of these groups of Huber clays.

HUBER

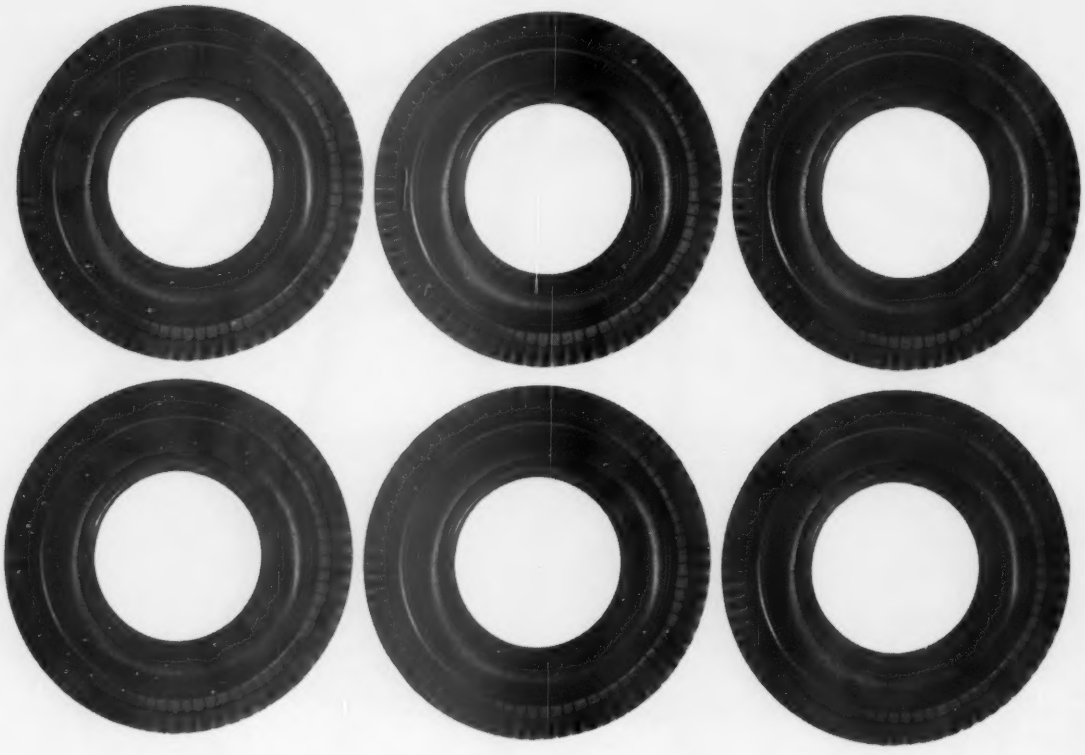
J. M. HUBER CORPORATION

630 THIRD AVENUE, NEW YORK 17, N. Y.

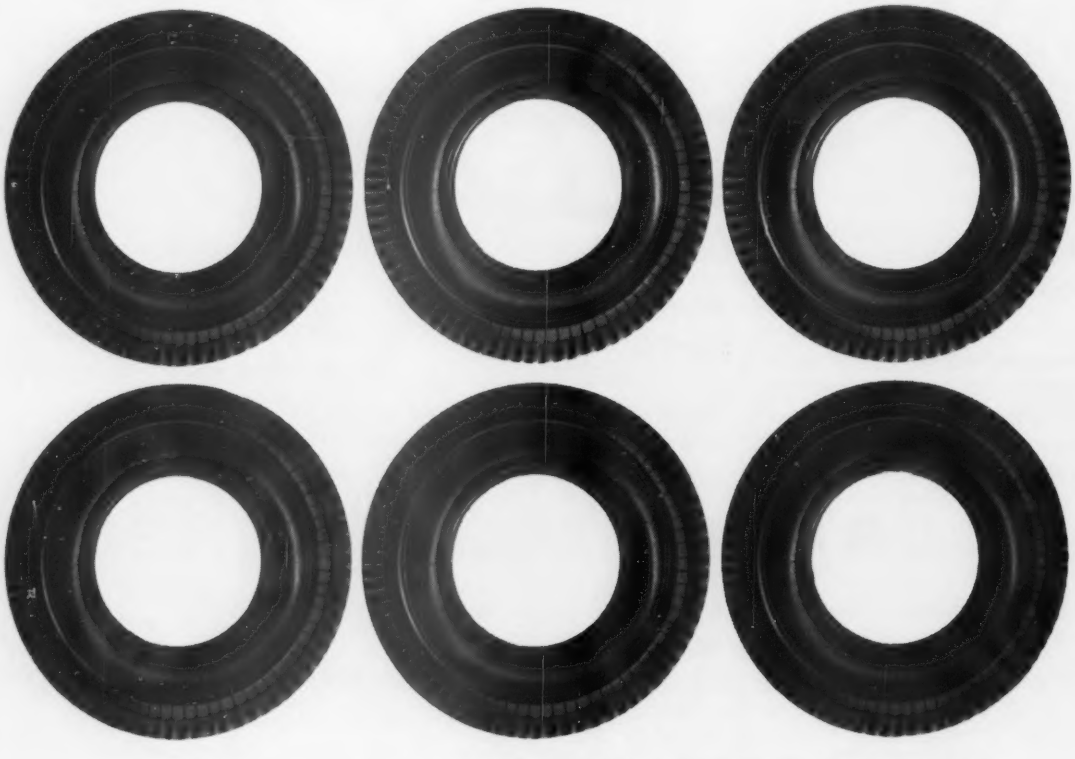
Carbon Blacks • Clays • Rubber Chemicals

For rubber reinforcing pigments, think of HUBER

Wise Owls Read Huber Technical Data. Ask to be put on our mailing list.



You get more than a "BAKER'S DOZEN"



Shell manufactures no finished rubber products—only high-quality synthetic rubber and raw materials for the rubber industry

with SHELL's oil-extended rubber

The low cost of Shell's oil-extended rubber offers you even more than the baker's proverbial thirteen for twelve—and you get *high quality* too! Tire treads and swim fins; camelback and floor mats—many products requiring toughness and long wear are made with these economical polymers.

Shell oil-extended rubber is used extensively in *first line* passenger treads and camelback. Accomplishment of such rugged assignments indicates the excellent wearing qualities obtained with these polymers. Long-wearing, high-viscosity rubber hydrocarbon—too tough for processing by itself—is combined with oil at the latex stage and the result is good workability together with outstanding physical properties.

For LIGHT COLOR, try recently improved S-1703 and S-1707. Non-discoloring and non-staining, they are unusually light in appearance. For GREATEST ECONOMY where color is unimportant, Shell offers the following: S-1712 for easiest processing; S-1709 for moderate tack and S-1710 for applications where tack is not required.

Other Shell S-Polymers include non-extended hot and cold rubber; black, oil-black and resin-rubber masterbatches and hot and cold latices—the widest variety of rubber polymers available from a single source.

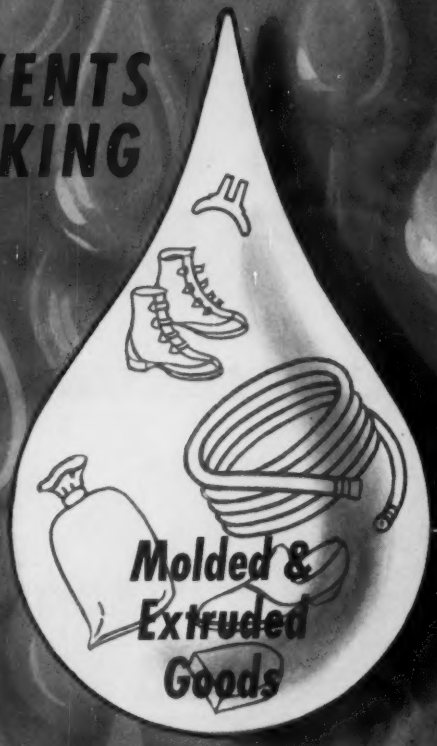
SHELL CHEMICAL COMPANY
SYNTHETIC RUBBER DIVISION
P. O. BOX 216, TORRANCE, CALIFORNIA
110 WEST 51ST STREET, NEW YORK 20, N. Y. • 1296 UNION COMMERCE BLDG., CLEVELAND 14, OHIO

SHELL

GLYCERIZED
(LIQUID CONCENTRATE)
LUBRICANT

PREVENTS STICKING

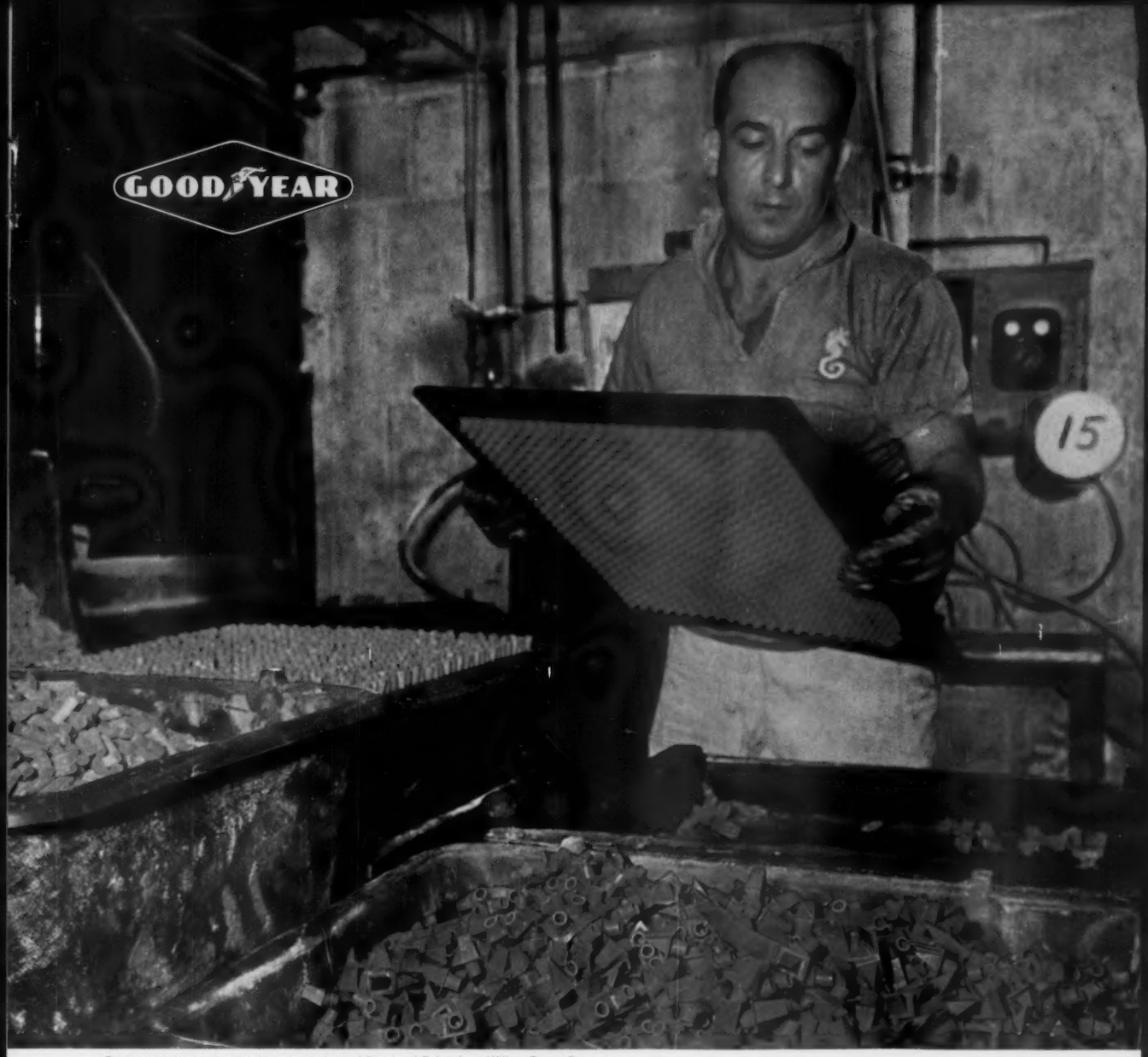
A microscopic film of
GLYCERIZED LUBRICANT
(LIQUID CONCENTRATE)
You won't be able to see it on the rubber but you will know of its presence because of the non-adhesive properties it imparts. Does not interfere with tack or knit of stock.
ASK FOR SAMPLE



HIGHLY CONCENTRATED
1=50
1 DRUM MAKES UP TO 50 DRUMS OF WORKING SOLUTION

GENSEKE
BROTHERS
RUBBER MATERIALS DIVISION
West 48th Place and Whipple Street
CHICAGO 32, U. S. A.

Also Mfgrs. of **RUBBEROL** **SYNTHOL** **MICROFLAKE**



Photograph taken through the cooperation of Eberhard Faber Inc., Wilkes Barre, Penna.

To profit more from the mistakes of others–use PLIOFLEX!

Human error is the basic reason why one leading manufacturer produces over 2,000,000 pencil erasers per day.

But he makes no mistake when he uses PLIOFLEX to make the most of the situation. Compared to the natural product used prior to World War II, PLIOFLEX offers these definite advantages: 1. No premastication required. 2. Much greater uniformity and cleanliness. 3. Reuse of scrap without grinding to powder. 4. Better aging qualities. 5. More uniform price.

How can PLIOFLEX improve your profit picture? Full details are yours by writing Goodyear, Chemical Division, Dept. Q-9419, Akron 16, Ohio.

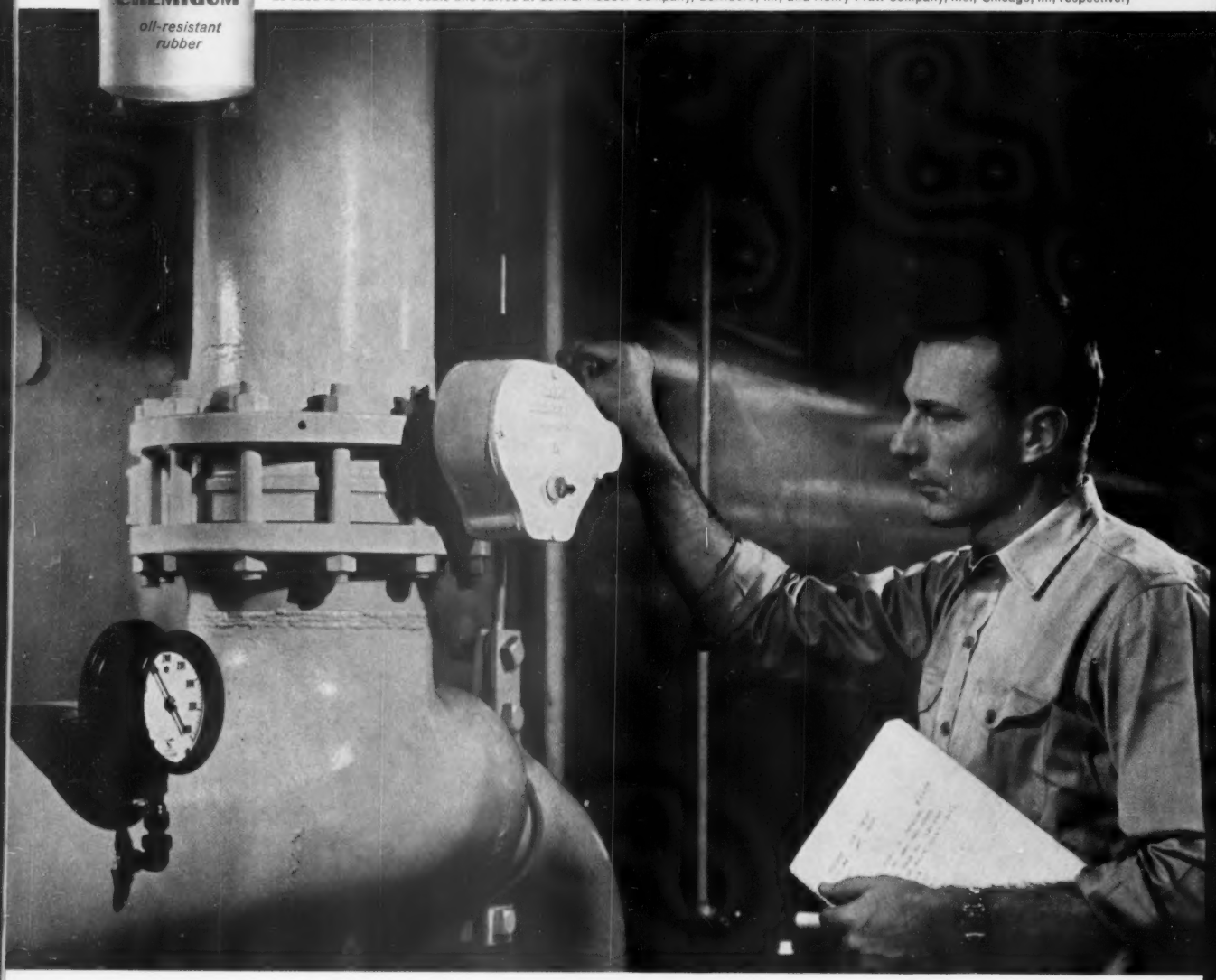
lots of good things come from

GOODYEAR

CHEMICAL DIVISION

Pliolex–T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

—as used to make better seats and valves at Central Rubber Company, Belvidere, Ill., and Henry Pratt Company, Inc., Chicago, Ill., respectively



10,000 Good Turns – all easily done with CHEMIGUM!

Quite new in concept is the "butterfly" valve pictured here. It quickly and surely controls the flow of highly corrosive liquids at pressures up to 150 pounds and, in tests, easily survives 10,000 cycles — the equivalent of 20 years' service.

Much of the valve's success stems from the use of CHEMIGUM in its integrally molded seat. CHEMIGUM was chosen because of its easier processing, better bonding and excellent resistance to petroleum products, chemicals, water and wear.

How can CHEMIGUM help your product take a turn for the better? Full details are yours by writing Goodyear, Chemical Division, Dept. Q-9419, Akron 16, Ohio.

Chemigum – T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR

CHEMICAL DIVISION

Photograph taken through the cooperation of Acushnet Process Company, New Bedford, Mass.

WING-STAY 100 checks the effects of oxygen—and ozone

It's no easy task to develop a good brake cylinder boot compound.

Part of the problem is the frequent flexing under exposure to hydraulic fluid and heat. But equally important are the effects of oxygen and ozone degradation.

A happy solution was found by one leading manufacturer in the form of WING-STAY 100. This triple-action chemical (stabilizer, antioxidant *and* antiozonant) proved most effective against atmospheric attack in extensive laboratory and field tests. Moreover, it displayed excellent processing qualities.

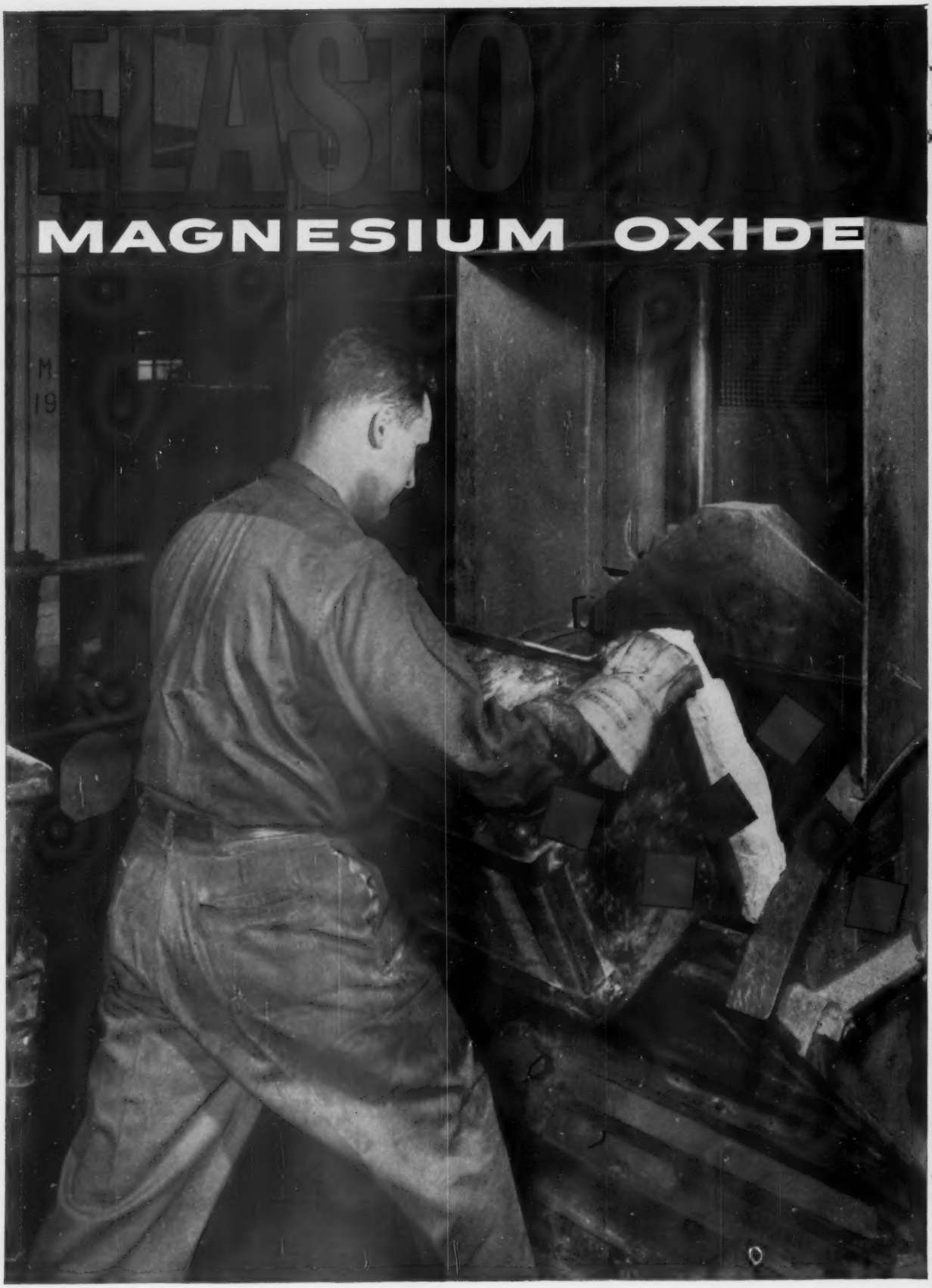
Why don't you look into the extra protection of WING-STAY 100? Full details, including the latest *Tech Book Bulletins*, are yours at Goodyear, Chemical Division, Dept. Q-9419, Akron 16, Ohio.

Lots of good things come from

GOODYEAR

CHEMICAL DIVISION

Wing-Stay—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio


MAGNESIUM OXIDE

...cuts throw-away losses from hot, scorchy stocks!

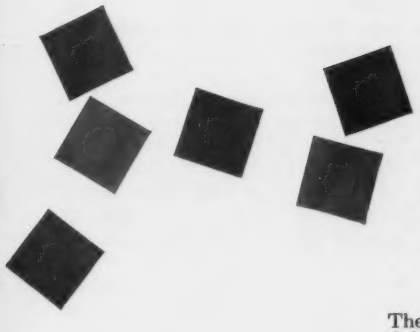
Morton's new activity-controlled oxides minimize scorch, improve bin stability ...give you higher-quality rubber

Pick the process safety you want . . . and get it *every* time with new Morton ELASTOMAG oxides! This new Morton development lets you use sensitive elastomer recipes without guesswork, or risk of loss! For the first time, you can predict process and curing aid performance with complete accuracy. This simplifies scheduling . . . boosts production . . . profits, too!

Three ELASTOMAG activity grades—high, medium, and low—make it easy to use sensitive recipes time after time without trouble. Each grade is held within extremely close limits on the Morton Activity Index scale for precisely predictable performance.

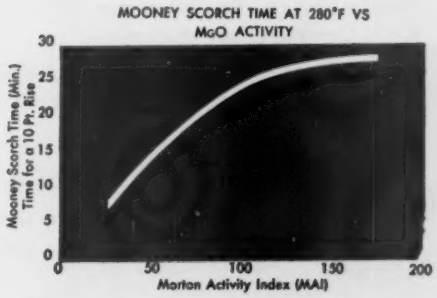
New Morton Activity Index (MAI) simplifies the use of magnesium oxide. It tells you the speed at which oxide will react . . . lets you choose an ELASTOMAG with the MAI value that provides best process safety, rate of cure, and state of cure. Morton researchers have proved that MAI—when used with oxides having superior dispersion—is a precision tool for predicting performance. Morton's new ELASTOMAG oxides are based on this research.

New ELASTOMAG Micro-Pellets—Dusting problems are minimized by Morton's new Micro-Pelletizing process. No binder or treating agent is used. In the mixer, Micro-Pellets break down to minute particles . . . provide the same superior dispersion as ELASTOMAG in the powdered form.



Predict process safety with new accuracy

Here's how Morton ELASTOMAG controls Mooney Scorch time. Notice how oxides with high Morton Activity Index (MAI) values give maximum safety. ELASTOMAG grades available have MAI ratings of 20, 100, and 170.



There's an ELASTOMAG oxide that can increase production in your plant. Ask your Morton Man for technical information and a copy of Morton's new ELASTOMAG bulletin. Distributors are listed below. Phone or write now.

Akron Chemical Company
255 Fountain Street
Akron, Ohio

Ernest Jacoby & Company
585 Boylston Street
Boston 16, Massachussetts

O'Connor & Company
4667 North Manor Avenue
Chicago 25, Illinois

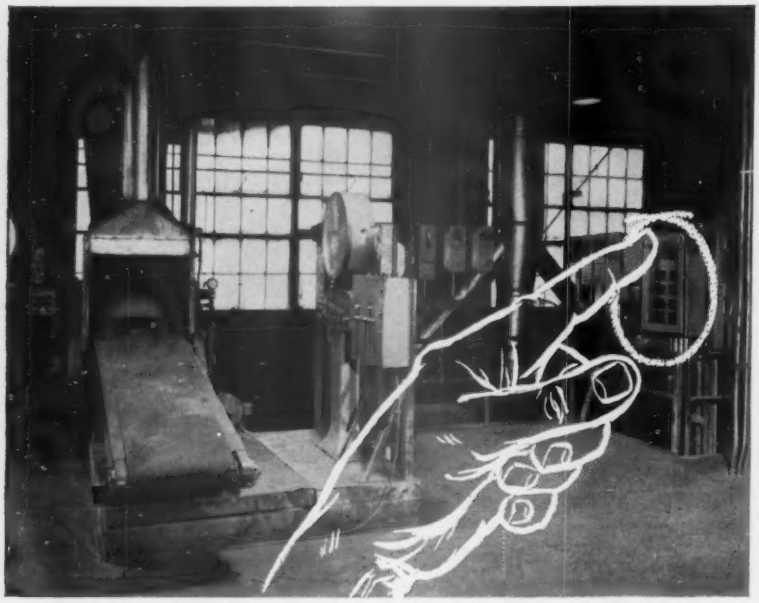
H. M. Royal, Inc.
689 Pennington Avenue
Trenton, New Jersey

H. M. Royal, Inc.
11911 Woodruff Avenue
Downey, California

MORTON CHEMICAL COMPANY
110 N. Wacker Drive—Chicago 6, Illinois—Financial 6-6760

Photo courtesy of Chicago Rawhide Company

AT LEE RUBBER & TIRE CORP. THE OPERATOR PUSHES A BUTTON...



...and their ROBOTRON* Controller automatically sequences the Banbury®

Recently installed on a Farrel-Birmingham Banbury Mixer at Lee's Conshohocken, Pa., plant the Taylor-Emmett ROBOTRON Batch Cycle Controller automatically—

- controls raising and lowering of the ram
- regulates the admission of raw ingredients on a time and sequence basis
- dumps the batch
- automatically resets for the next batch

The ROBOTRON Controller panel is so simple that batching cycles for compounding different products can be changed in as little as 10 seconds.

Lee is assured of uniform quality product from each batch; minimum cycle time; reduced operating costs.

To find out how you can put this instrument to work on your time cycling problems, call your Taylor Field Engineer, or write Taylor-Emmett Controls, Inc., Akron, Ohio, or Taylor Instrument Companies, Rochester, New York, or Toronto, Ontario.

*Trade-Mark

Taylor-Emmett Controls, Inc.
A SUBSIDIARY OF Taylor Instrument Companies

News in Brief

► First Machinery Corp., 209 Tenth Street, Brooklyn, N. Y., has issued two publications: "Handy Reference Engineering Constants," which contains short-cut tables, formulas and technical data required frequently in plant operation; and "First Facts," a pocket-size equipment guide.

► Magnatrol Valve Co., Hawthorne, N. J., has recently published a 20-page catalog describing and illustrating its complete line of electrically controlled magnetic solenoid valves.

► A case history describing dollar savings in floor space at one warehouse through unique plant layout and proper integration of materials handling equipment, is the subject of Case History Bulletin 509-3, published by Lewis-Shepard Products, Inc., Watertown 72, Mass.

► Crane Co., Chicago, Ill., producer of residential and industrial valves, has appointed N. W. Ayer & Son as its advertising agency.

► John K. Bice Co., Los Angeles, Calif., has been named by J. M. Huber Corp., New York, N. Y., as exclusive distributor for its new series of Huber kaolin clay extenders and Zeolex synthetic silicate pigments to the paint, varnish, printing ink, plastics and specialty processing industries in Southern California, Arizona, New Mexico, Utah, Colorado and Wyoming.

► Firestone Tyre & Rubber Co., Ltd., Bombay, India, has received the Award of Honor from the National Safety Council for completing 6,679,236 injury - free man - hours. The plant's employees worked 23 months without a lost-time injury.

► Buxbaum Co., Canton, Ohio, reports that the processing of raw rubber in the manufacture of its Traffic-Master floor matting has been simplified by using Ameripol Micro-Black 4751, a styrene - butadiene black masterbatch developed by Goodrich - Gulf, Inc., Cleveland, Ohio.

► Techline Division, Wheelabrator Corp., Vicksburg, Mich., has developed an abrasive called Liquasheen, which is reported to give abrasive selection on the application of wet blasting.

Just Published *comprehensive manual on*
HANDLING C_4 HYDROCARBONS

Having higher vapor-pressure, Petro-Tex C_4 Hydrocarbons require somewhat different handling and unloading facilities and techniques than heavier olefins. Our new manual, "Handling C_4 Hydrocarbons", provides prospective users a background for understanding these differences and the voluminous codes and regulations on the safe handling of flammable hydrocarbons in pressure-type containers.

Included are shipping data on all Petro-Tex chemicals as well as handling and storage techniques and general information regarding the unloading of cylinders, tank trucks, tank cars and barges. Fire and explosion precautions and a bibliography of references to safety codes and governmental regulations (keyed to the text) complete this useful manual.

We will be pleased to send a copy to those whose work may lead to broader use of Petro-Tex chemicals. We also invite inquiries on

BUTADIENE **ISOBUTYLENE** **DIISOBUTYLENE**
TRIISOBUTYLENE **n-BUTENE-1** **n-BUTENE-2**

Petro-Tex®

PETRO-TEX CHEMICAL CORPORATION

8600 PARK PLACE BOULEVARD, HOUSTON 17, TEXAS

fmc JOINTLY OWNED BY FOOD MACHINERY AND CHEMICAL CORPORATION TENNESSEE GAS TRANSMISSION COMPANY

coming events

May 19. Washington Rubber Group, Election of Officers, Washington, D. C.

May 20. Connecticut Rubber Group, Technical Meeting, Rapp's Paradise Inn, Ansonia, Conn.

May 20. New York Rubber Group, First Annual Dinner-Dance, Roosevelt Hotel, New York, N. Y.

May 20-31. International Plastics Exhibition, Oslo, Norway.

May 23-25. American Supply & Machinery Manufacturers Association Show, Conrad Hilton Hotel, Chicago, Ill.

May 23-26. American Society of Mechanical Engineers, Design Engineering Conference and Show, Statler Hilton Hotel, New York, N. Y.

May 23-27. American Textile Machinery Exhibition, Atlantic City, N. J.

May 23-28. Instruments, Electronics and Automation Exhibition, London, England.

May 27. Rubber Chemical Salesmen's Association of Akron, University Club, Akron, Ohio.

June 1-3. Association of American Battery Manufacturers, Spring Convention, Ambassador Hotel, Los Angeles, Calif.

June 1-3. Commercial Chemical Development Association, Sea View Country Club, Absecon, N. J.

June 1-3. Instrument Society of America, 6th Annual Instrumental Methods of Analysis Symposium, Montreal, Quebec, Canada.

June 3-12. International Trade Fair, Expo Oresund, Helsingborg, Sweden.

June 3-5. Los Angeles Rubber Group, Summer Outing, Hotel Del Coronado, Coronado Island, Calif.

June 3. Quebec Rubber & Plastics Group, Annual Golf Tournament, Ste. Hyacinthe Golf Club, Ste. Hyacinthe, Quebec, Canada.

June 4. Southern Ohio Rubber Group, Summer Meeting, Inland Activities Center, Dayton, Ohio.

June 5-10. American Society of Mechanical Engineers, Semi-Annual Meeting & Aviation Conference, Statler Hilton Hotel, Dallas, Texas.

June 5-10. Society of Automotive Engineers, Summer Meeting, Edgewater Beach Hotel, Chicago, Ill.

June 5-9. Society of the Plastics Industry, 9th National Plastics Exposition and Conference, New York Coliseum and Commodore Hotel, New York, N. Y.

June 5-9. World Power Conference, Madrid, Spain.

June 8-11. National Society of Professional Engineers, Annual Meeting, Statler Hotel, Boston, Mass.

June 9. New York Rubber Group, Summer Outing, Doerr's Grove, Millburn, N. J.

June 9. Rhode Island Rubber Group, Summer Outing.

June 9-10. Wire Association, Pacific Coast Regional Meeting, Statler-Hilton Hotel, Los Angeles, Calif.

June 9-11. Manufacturing Chemists' Association, 88th Annual Meeting, Greenbrier, White Sulphur Springs, West Va.

June 10. Fort Wayne Rubber & Plastics Group, Golf Outing, Tippecanoe Lake Country Club, Leesburg, Ind.

June 10. Northern California Rubber Group, Golf Outing.

June 10-11. Southern Rubber Group, Technical Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.

June 10-26. British Exhibition of Industry, Technology, Science and Culture, New York Coliseum, New York, N. Y.

June 12-15. American Nuclear Society, National Meeting, Palmer House, Chicago, Ill.

June 13-15. Chemical Institute of Canada, 43rd Annual Conference and Exhibition, Chateau Laurier Hotel, Ottawa, Ontario, Canada.

June 13-17. Eighth Annual Technical Writers' Institute, Rensselaer Polytechnic Institute, Troy, N. Y.

June 13-17. Gordon Research Conferences, Elastomers, Colby Junior College, New London, N. H.

June 14-18. International Symposium on Macromolecular Chemistry, Moscow, U.S.S.R.

June 16. Washington Rubber Group, Annual Outing, Brooke Manor Country Club, Washington, D. C.

June 16-17. Division of Colloid Chemistry, American Chemical Society, 34th National Colloid Symposium, University Center, Lehigh University, Bethlehem, Penna.

June 17. Akron Rubber Group, Summer Outing, Firestone Country Club, Akron, Ohio.

June 17. Boston Rubber Group, Summer Outing, Andover Country Club, Andover, Mass.

June 18-26. Plastics Industries Exhibition, Europlastica 60, Ghent, Belgium.

June 19-22. American Institute of Chemical Engineers, Del Prado Hotel, Mexico City, D.F.

June 20-24. Gordon Research Conferences, Information and Documentation, New Hampton School, New Hampton, N. H.

June 20-July 5. Chicago International Trade Fair, Navy Pier, Chicago, Ill.

June 21-30. International Chemical Exhibition, Belgrade, Yugoslavia.

June 24. Detroit Rubber & Plastics Group, Summer Outing, Western Country Club, Detroit, Mich.

June 26-July 1. American Society for Testing Materials, Annual Meeting, Chalfonte - Haddon Hall, Atlantic City, N. J.

June 29-July 1. Committee D-11 on Rubber and Rubber-Like Materials, ASTM, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

Sept. 8-9. Tenth Canadian High Polymer Forum, Alpine Inn, Montreal, Quebec, Canada.

Sept. 13-16. Division of Rubber Chemistry, American Chemical Society, Fall Meeting, Hotel Commodore, New York, N. Y.

Sept. 21-23. Society of the Chemical Industry, Plastics and Polymer Group Symposium, London, England.

October 4-7. International Rubber Conference, West Berlin, Germany.

Oct. 9-12. American Society of Mechanical Engineers, Rubber and Plastics Conference, Lawrence Hotel, Erie, Penna.

Oct. 10-19. International Congress on Technology of Plastics Processing & International Plastics Exhibition, Amsterdam, Netherlands.

Oct. 11-13. Second International Synthetic Rubber Symposium, Church House, Westminster, London, England.

Oct. 19-26. Second International Plastics Fair, Macroplastics, Utrecht, The Netherlands.

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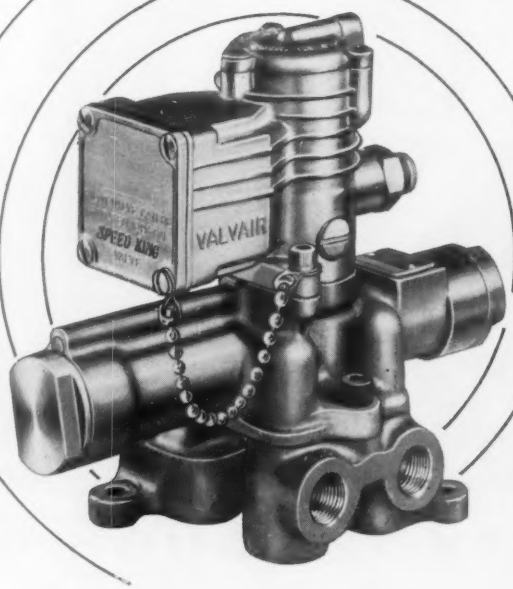

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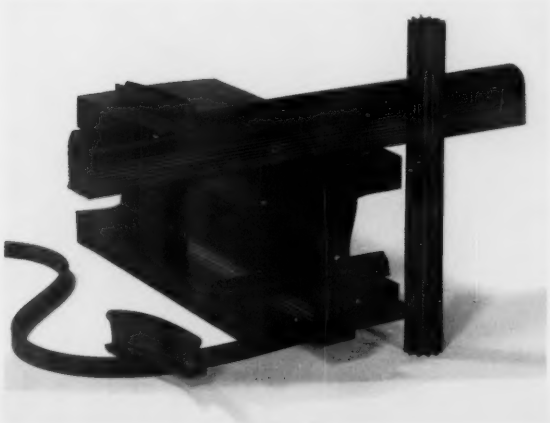

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• During the month of June the Dunlop Rubber Co. will start construction of a tire factory in Petaling Jaya, Malaya, with a capacity of 400,000 tires a year. Half of the production will cover Malayan requirements; the balance will be exported. The factory, which will employ approximately 800 people, will go on stream within 18 months. Initially, about 2,000 tons of Malayan rubber will be processed per year. Part of the required capital will be contributed by Malayan industrial and banking circles. In order to protect domestic production, Dunlop is trying to have the government restrict imports or assess higher customs duties for foreign merchandise.

• Last year German production of heavy truck tires rose by 38.8 per cent, agricultural tire production increased by 40.6 per cent, small truck tire production increased by 20.5 per cent and production of tires for cars rose by 19.1 per cent. Bicycle and motorcycle tire production went up 7.9 per cent, with motor scooter tires up 4.3 per cent. Production of accessories for all kinds of tires increased by 9.6 per cent.

• London rubber trade circles believe that the center of the rubber trade in the Far East will move from Singapore to Malaya this year. The Prime Minister of the Commonwealth of Malaya has been approached by English trade circles with a proposal to approve the organization of a commodity exchange in Kuala Lumpur, the capital of Malaya. All planters and dealers would eventually become members of the new corporation and the scope of the exchange would be enlarged by organizing a clearing authority to be responsible for the supervision of all contracts and to enforce adherence to contract terms.

Trade circles in London and other European cities believe that the commodity exchange in Singapore can no longer continue operating satisfactorily as it is located too far from the rubber producing parts of Central and Northern Malaya. The majority of the European, Malayan and Chinese traders have already established branches in Kuala Lumpur because the main offices in Singapore do not operate efficiently.

• Last year the Italian rubber industry manufactured about 156,000 tons of rubber goods — an increase of 18 per cent over 1958. Approximately 97,775 tons of car tires, an increase of 20.6 per cent, were turned out during 1959; technical rubber goods production amounted to 41,345 tons, representing an increase of 13 per cent. Last year 8,180 tons of rubber shoes were delivered, corresponding to an increase of 19.2 per cent. The output of bicycle tires amounted to 6,520 tons, 5.3 per cent more than in 1958.

• At the beginning of this year the German tire factories applied to the supervising cartel authority of the German government for the registration of a cartel covering all kinds of tires. Prior to that, almost all factories had adjusted their list prices and concluded an agreement regulating the various trade discounts.

The cartel authority rejected the application because there is no competition among the various manufacturers. Foreign tires, said by some to comprise 4.8 per cent of the market, are not of sufficient importance to alter the competitive picture. Furthermore, prices of most of the foreign tires are on a level with German prices, because the tires are shipped from factories which have agreements with German manufacturers. The German rubber industry cited recapped tires in its proof of competition. This the authority flatly rejected, pointing out that recaps are not equivalent to new tires. Foreign tires are imported from England, France, Austria, Holland and Italy.

Quite a number of German industries have—according to articles published in the German press—tried to establish similar cartels. Up to now the supervising authority has hesitated to oppose this trend. However, the case of tires has now been singled out. It is conceivable that it will be carried to the highest court, which means it will be quite some time before a final decision will be rendered. Because the cartel authority did not object to the agreement regulating discounts, the cartel for the fair trade prices remains in force until a decision of the court is given.

• The International Rubber Conference dealing with synthetic rubber and synthetic staples for the rubber industry will be held in Berlin this year. From October 4 to 7, experts on rubber and synthetic staples from 30 nations will meet in the Congress Hall in Berlin to exchange experiences and discuss the latest scientific achievements. Problems of chemistry, physics and technology of synthetic rubber will be covered. A number of papers concerning syn-

thetic fibers will be presented. The conference is sponsored by the German Rubber Association. Rubber processing and rubber testing machinery will be exhibited by leading manufacturers of all the countries in the world. The rubber show will, for the first time, convey a cross-section of international trends in developing synthetic staples which are so important for the production of rubber goods.

• Within 5 years, output of natural rubber in Malaya, presently amounting to 690,000 tons, will, according to the Rubber Research Institute in Malaya, rise to 900,000 tons per year. The increase will be made possible by more extensive use of hormones which generate a 30 per cent increase in yield per tree. Hormones like dichlorophenoxy acetic acid and trichlorophenoxy acetic acid, in conjunction with palm and coconut oil, are used for the treatment. Improved tapping methods will play a part in the increase, as will selective breeding. A new technique of injecting certain minerals into rubber trees is said to show great promise although it is not yet used commercially.

• A glimpse behind the iron curtain is sometimes caught by looking through foreign trade papers. The *Indian Rubber Bulletin*, published in Calcutta, contains a full page advertisement which we quote:

> Butadiene-Styrene Cold Rubber KBS 3012, a general-purpose rubber for tires, tubes, hoses, conveyor belting, floor tiles, technical and mechanical articles, etc.
>
> Supplier: Ciech, Import and Export of Chemicals, Poland, Warszawa 10, P.O. Box 343, Cables: Ciech-Warszawa.
>
> Synthetic Rubber as well as other goods can be imported from Poland against payment in non-transferable Indian rupees on special licenses obtainable through S.T.C.
>
> For particulars please contact: Trade Representation of the Polish People's Republic in Calcutta, 28 Stephen Court, 18/A, Park Street, Calcutta.

It is remarkable that Poland finds herself in a position to extend large credits to undeveloped countries. When applying in Washington for loans in order to obtain merchandise or machinery from the United States, Poland always presents herself as being in a very precarious financial condition, requiring extended credits for many years.

"Furthermore," the innocent capitalist asks himself, "where is her butadiene-styrene cold rubber coming from?" According to our information, Russia and her satellites are just starting to produce synthetic rubber on a large scale and production by no means covers the requirements of these huge territories. How is it they are able to export?

Turning the page of the Indian publication we find another full page advertisement which reads:

> For the production of rubber goods we are pleased to offer you accelerators, antioxidants, blowing agents, factices, reclaimed rubber.
>
> Representative: N. Jivanlal & Co., Private Ltd., 50 Princess Street, Bombay 2, India.
>
> Chemapol—Praha—Czechoslovakia.

Incidentally, this particular ad is embellished by a fairly good drawing of a heavy tire.

We are happy to find six full pages inserted by American concerns in the same issue. Of course, there is keen competition with a number of English and Canadian companies, and even the Farbenfabriken Bayer AG, Leverkusen, are represented by a very effective ad offering a light-colored isocyanate-base bonding agent.

• The U.S. Rubber Reclaiming Co. has granted a license to Gamid Rubber Products & Plastics Ltd., Natanya, Israel, a subsidiary of Koor-Industries & Crafts Ltd., for its "Reclaimator" rubber reclaiming process. A plant will be built in Natanya with an initial daily capacity of 7,000 pounds, and an ultimate capacity of between 20,000 and 25,000 pounds. Production will start early in 1961. Gamid will purchase a cracking-mill for shredding scrap rubber, a fabric separating system, a fine grinding machine and a Reclaimator unit from U.S. Rubber. The initial cost will be $300,000 with additional units for expanding capacities costing $90,000 each. Negotiations are under way for similar agreements in Brazil, India, Japan and other countries.

• A new Dow office in Germany will handle the marketing of Dow chemicals, plastics and agricultural products in Germany, Austria and Switzerland. Sales in these countries will be processed as before through appointed sales representatives. The address of the new marketing office is: Deutsche Dow Chemie GmbH, Weissfrauenstrasse 3, Frankfurt a/M, Germany.

Dow is opening an office in Milan, Italy, to handle the marketing of its products in Italy, Greece and the Near East. The Italian subsidiary, Dow Chimica Italiana S.p.A., of the Dow Chemical Company of Midland, Mich. has opened a new marketing office at Via Larga 31, Milan, Italy.

• Austrian production of plastic raw materials and plastic merchandise has tripled during the last four years. In 1954, only 10,000 tons were produced while 14,600 tons were produced in 1955 and in 1958, 29,750 tons were manufactured. Having obtained licenses of American patents, small containers made of polyethylene, particularly tubes and bottles, will henceforth be manufactured in Austria.

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- *hydraulic drop door*
- *roller bearings*
- *self-sealing dust stops*

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New bodies can be supplied with roller bearings. These are a particularly good idea for customers with "hot" machines. Self-sealing dust stops are also available for either rubber or plastics Banburys.

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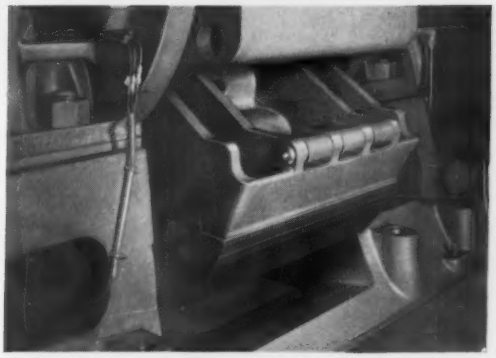

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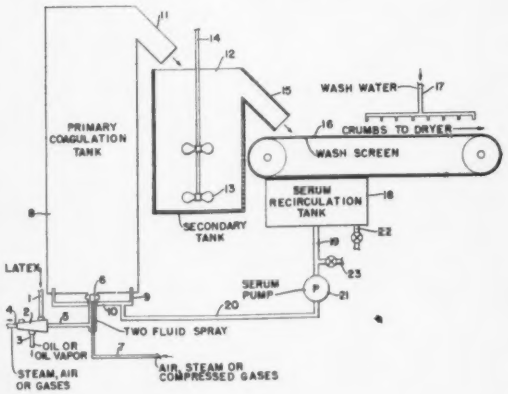
PATENT REVIEW

by Melvin Nord

Coagulating Rubber Latices

U.S. Patent 2,915,489, issued Dec. 1, 1959 to James W. White, assigned to Columbian Carbon Co., describes a method of coagulating rubber latices, in which the customary creaming step is eliminated. Also, the resultant rubber crumb is more readily washed and dried, and undesirable side effects of the salt creaming are avoided.

As illustrated below, the latex is passed under pressure through line (1) into a downstream chamber of an eductor-type mixer (2) passing oil or oil vapor under pressure through conduit (3) and steam, air or other substantially inert gas under pressure through conduit (4) into an upstream chamber of the mixer. The resultant oil



extended polymer is passed from the mixer through conduit (5) to a two-fluid spray type atomizer (6) and the atomizing gas is passed under pressure to the atomizing nozzle through conduit (7).

The oil extended polymer is atomized by atomizer (6). The atomized stream is injected upward into the bottom of a coagulation tank (8) filled with an acid coagulating medium at a pH of 1.5 to 3. Recycled serum is injected upward into the bottom of tank (8) through inlet tubes (9) connected to header (10).

Upon contact with the acid coagulating medium, the atomized latex is rapidly coagulated to form aggregates of sponge-like structure, which are continuously floated through the coagulating tank (8) by the upwardly flowing serum. These sponge-like aggregates are carried out of the upper end of the tank through chute (11) by the overflowing serum into a secondary tank (12). secured to shaft (14) adapted for high speed This tank is equipped with propeller blades (13)

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For bonding nitrile rubbers

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The single-coat system for bonding natural and SBR compounds

1. Clean the metal surface by degreasing; then sandblast, pickle, or buff.
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4. Apply an even coat of TY-PLY to the cleaned metal surface. Allow to dry.
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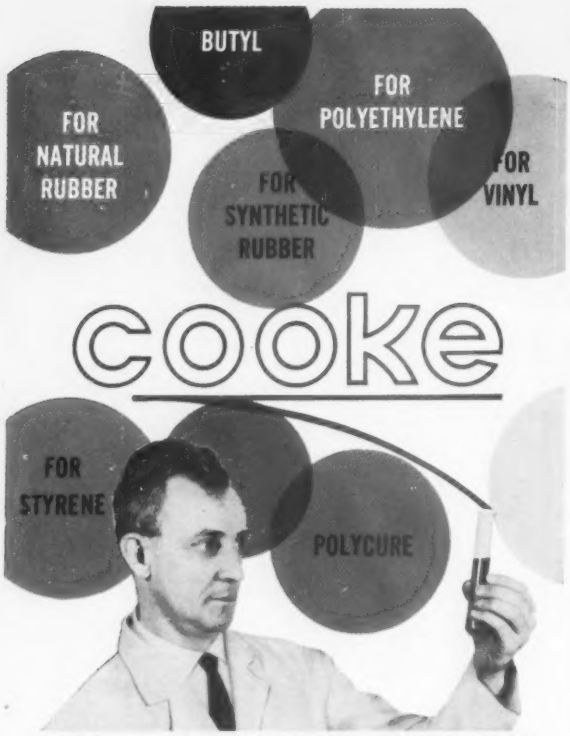

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GArden 5-5935 Hackettstown, N. J.

PATENT REVIEW

rotation. By propeller action, the sponge-like aggregates discharged into tank (12) from coagulating tank (8) are readily broken up into crumbs of about ½ to ¾ inch diameter to facilitate separation of the serum from the coagulated rubber as well as washing and drying of the resultant crumb.

Tank (12) is likewise filled with an acid coagulating medium similar to that in tank (8). The serum carrying the crumb rubber in suspension overflows through chute (15) onto a separating and washing screen of the continuous type (16). The separated crumb rubber is carried by the moving screen beneath the water sprays (17) for washing and is then conveyed to a conventional drying apparatus.

Vulcanizable Elastomer Pellet

U. S. Patent 2,906,740, issued Sept. 29, 1959, to John Becker and Charles E. McCormack and assigned to E. I. du Pont de Nemours & Co., describes a process for preparing and extruding elastomer stocks in the form of pellets, without scorching.

The pellets are cut from ¼-inch extruded rods of compounded stock. They are then tumbled with an active vulcanization non-scorching accelerator. For polychloroprene, a typical accelerator would be a liquid butyraldehyde-aniline condensation product. The pellets are then coated with talc to prevent them from adhering to each other. There is no substantial vulcanization when pellets are stored at room temperature, even though the active accelerator is in contact with the vulcanizable stock.

When the coated stock is extruded at 200° to 225° F., there is no evidence of scorching. The vulcanizate shows good aging in air oven and oxygen bomb.

Recovering Hydrogenated Polymers

U. S. Patent 2,905,658, issued Sept. 22, 1959, to Richard E. Dietz and assigned to Phillips Petroleum Co., describes a method of recovering hydrogenated, rubbery polymers of butadiene in crumb form.

A solution of the polymer, from which the catalyst has been removed, is contacted with a mixture of isopropyl alcohol and water. From this solution, the ternary azeotrope of water, alcohol and the solvent are removed. The polymer precipitates, producing a slurry of non-agglomerated crumb. The crumb can be easily separated from this slurry and subsequently dried.

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PATENT REVIEW

Door Closure for Rubber Mixers

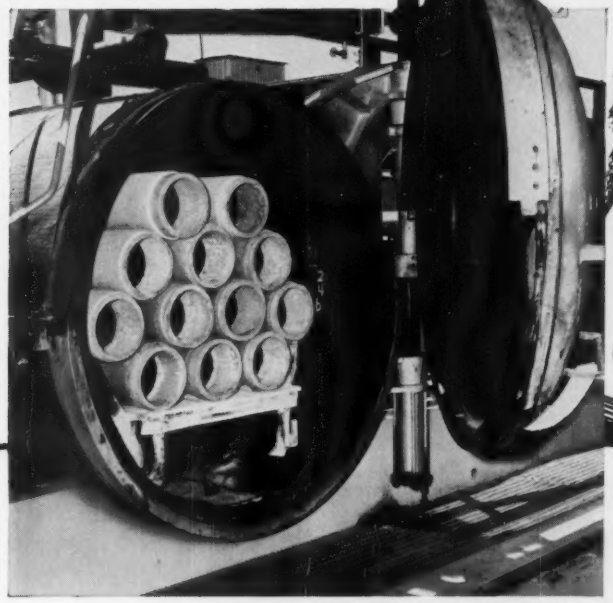
U.S. Patent 2,918,905, issued Dec. 29, 1959 to Douglas W. MacLeod and Henry V. Selbach, assigned to Farrel-Birmingham Co., Inc., provides an improved door closure for rubber mixers.

The object is to provide an air-pressure actuated means for operating the door closure member of a mixer. The device consists of a piston and cylinder provided with means for absorbing the shock of the impact of the piston against the cylinder at the end of each stroke.

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Low pressure warning signal for tubeless tires	Howard T. Russell	2,915,035	12/1/59
Method of manufacturing tires	Industrial Ovens, Inc.	2,915,102	12/1/59
Tire buffing machine	William C. Van Sickle et al	2,915,113	12/1/59
Rubber torsion spring	Albert F. Hickman	2,915,306	12/1/59
Tire trim member	James H. Barnes	2,915,335	12/1/59
Tire vulcanizing molds	Anthony T. Fassero et al	2,915,783	12/8/59
Manufacturing mats from rubber derivatives	Luciano Valentini	2,915,785	12/8/59
Rubber gloves	Veedip Ltd.	2,916,036	12/8/59
Mixtures of synthetic elastomers and resinous aldehyde-condensation products	Farbenfabriken Bayer A.G.	2,916,471	12/8/59
Tire safety wall	B. F. Goodrich Co.	2,917,096	12/15/59
Tubeless tire valve	Goodyear Tire & Rubber Co.	2,917,097	12/15/59
Tubeless tire rim valve	Goodyear Tire & Rubber Co.	2,917,098	12/15/59
Method of making hose with sealing rings attached at each end	United States Rubber Co.	2,917,102	12/15/59
Vulcanization of butyl rubber	United States Rubber Co.	2,918,448	12/22/59
Vulcanizable rubber mix	Societe Franterre	2,919,260	12/29/59

Copies of any patents, including those described here, are available from the Commissioner of Patents, Washington 25, D. C., for 25 cents each. Do not send stamps.



Memo to Production Engineers

◀ Adamson 90" dia. Hi-Lift Swing Door installed at Johns-Manville Products Corporation, Manville, N. J. One of many Adamson doors now in operation, or on order, for use in steam-curing TRANSITE® Pipe at J-M Plants in the U. S. and Canada.

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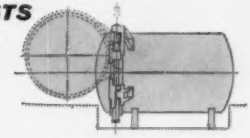


Adamson's lift-swing feature eliminates need for extended pit and expensive bridging. For example, on a 90" dia. door you can use an easily-handled loading bridge as short as 22".

2 TIGHT, LEAKPROOF SEAL

Adamson's special heat-resistant, self-sealing gasket utilizes vessel's internal pressure to assure a positive, leakproof seal.

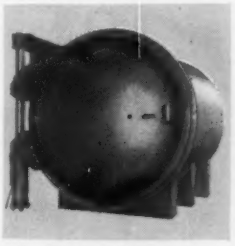
3 EFFICIENT SLIDE-LOCK DESIGN

Provides virtually 360° of locking surface between door and mating shell ring. *Twice* the locking area of conventional breech-lock doors!

4 SAFE, RELIABLE OPERATION

Equipped with automatic door locking pins. Can be furnished with optional steam interlock controls for complete safety. Other built-in safety features included.

5 STRONGER CONSTRUCTION



Conventional castings are replaced by sturdy pressed steel head welded to continuous roll forged locking rings.

6 FAST OPENING AND CLOSING

Quick-unlocking, vertical-lift action powered by hydraulic cylinder. Door swings easily on anti-friction and bronze sleeve bearings. Simple, trouble-free operation.

ADAMSON UNITED 7067

COMPANY

730 CARROLL STREET, AKRON 4, OHIO

Subsidiary of United Engineering and Foundry Company
Plants at Pittsburgh, Vandergrift, Wilmington, Youngstown, Canton

We offer a wide range of door sizes and pressures, available as integral equipment on vessels supplied by us, or as separate units for mounting on tanks made by other manufacturers. Write for catalog No. 562.

DESIGNERS AND BUILDERS OF BASIC MACHINERY AND EQUIPMENT FOR COMPLETE PROCESSES

A NEW SYMBOL

United Carbon Company
and its subsidiaries:

United Producing Company, Inc.

United Rubber & Chemical Company

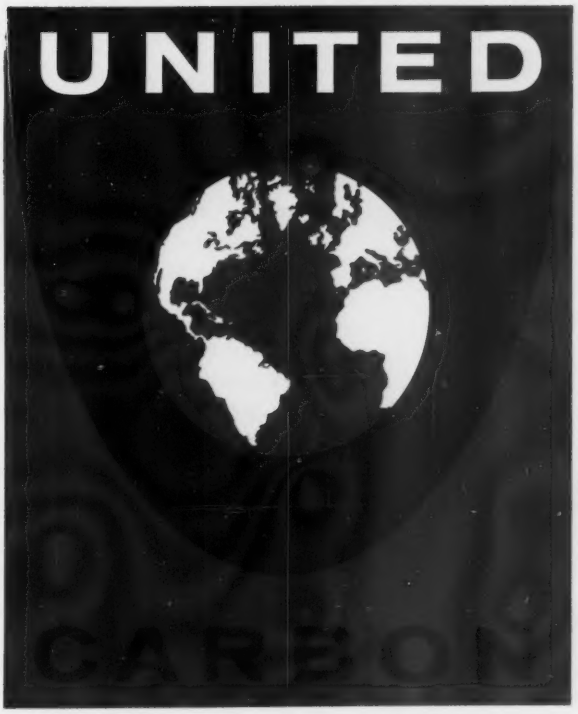
and

United Carbon Company, Inc.

take pleasure in presenting this new trademark. It is our hope that United's products and services to the rubber, paint, plastics, ink, oil and gas industries will cause this new symbol to take a place among the respected trademarks of international industry.

United Carbon Company
and its subsidiaries
produce and market:

Carbon black, synthetic rubber black masterbatches, crude oil and natural gas.



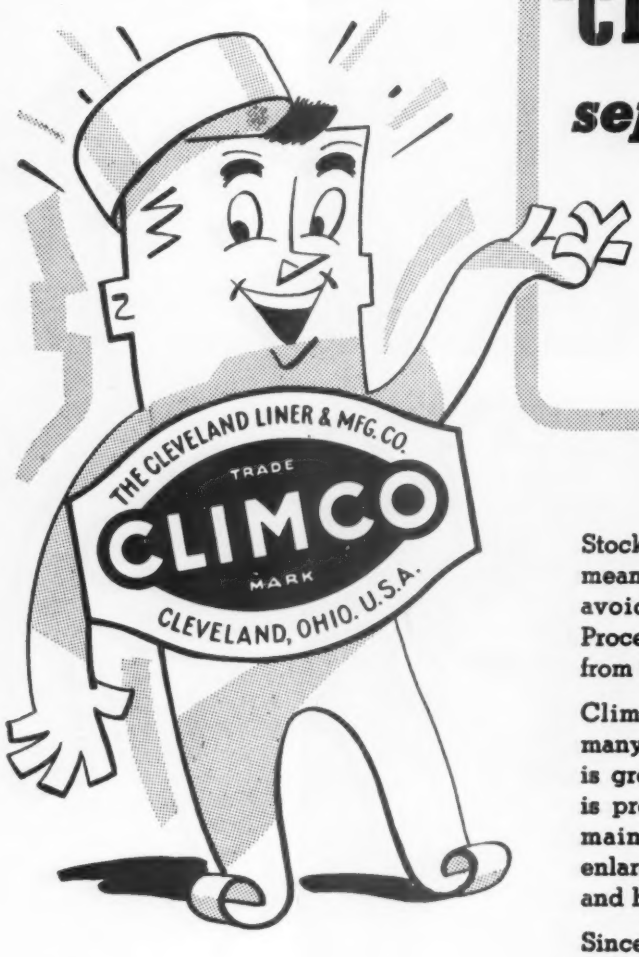
UNITED CARBON COMPANY, INC.
410 PARK AVENUE, NEW YORK 22, N. Y.

A Subsidiary of United Carbon Company

AKRON CHICAGO LOS ANGELES
BOSTON HOUSTON MEMPHIS

In Canada: CANADIAN INDUSTRIES LIMITED

MR. CLIMCO SAYS.....



"CLIMCO LINERS *separate perfectly from the stock"*

Stock adhesions at any point in production mean time lost and extra expense. You can avoid such headaches by using Climco Processed liners that can be readily peeled from the stock without sticking.

Climco Processing of your liners assures many other profitable advantages: Liner life is greatly increased, tackiness of the stock is preserved, and gauges are more easily maintained. Latitude in compounding is enlarged, lint and ravelings are eliminated and horizontal storage is facilitated.

Since 1922 Climco Processed Liners have proved their worth to the rubber industry. Give them a trial in your plant.

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ILLUSTRATED LINER BOOKLET

Tells all about Climco Liners and Linerette and how to get better service from liners. Write for your copy now.

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Serving the Industry Since 1921

LINERETTE INTERLEAVING PAPER
Treatment Contains
NO OIL OR WAX
Samples on Request

Flat bed body which generally transports solid cargo is quickly converted to a liquid carrier . . . with a SEALDTANK*

ENJAY BUTYL

Converts trucks to liquid carriers in minutes!

Enjay Butyl is used by the United States Rubber Company for "Sealdtanks" carrying up to 4,200 gallons. Sealdtanks are tube-like containers that can be rolled into compact units and stored on the truck when it returns with dry cargo. Note rolled Sealdtank at rear. Why was Enjay Butyl chosen for Sealdtanks? Because its excellent resistance to many chemicals, its remarkable toughness as well as all-weather resistance make it a most practical container for transporting various liquids.

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Versatile Butyl may well help improve the performance of your own products. Complete information and expert technical advice is available to you from Enjay.

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how to vastly increase the useful life of rubber...

Consider the effect of your curing system on the effectiveness of a chemical antiozonant

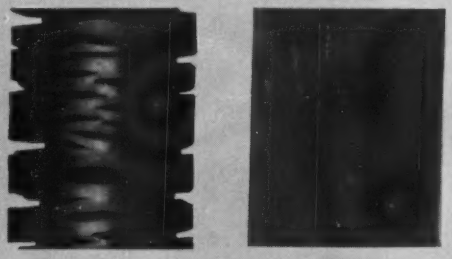
In compounding rubber, use of a potent antiozonant like UOP 88 or 288 is essential in assuring maximum crack-free life. But do you realize what a vast difference may be made by your *curing system?*

Look at the two rubber test strips illustrated. Both were formulated with UOP 88 . . . but note how much more effectively the antiozonant worked when accompanied by this change in curing systems —a vast increase in resistance to cracking!

Help in achieving maximum effectiveness from UOP 88 or 288 antiozonants is available through UOP facilities and technical personnel. Just write or telephone our Products Department.

UOP ozone cabinets provide test conditions at a wide range of ozone concentrations.

The SBR specimens below were exposed to ozone at 100°F with 20 percent elongation for 52 hr. at 33 pphm ozone, then 187 hr. at 63 pphm ozone.



Carbon black—HAF (high abrasion furnace), Curing system—4 phr tetramethylthiuram disulfide; Hours to first crack—7 to 23.

Carbon black—HAF (high abrasion furnace), Curing system—2 phr sulfur, 1 phr N-cyclohexyl-2-benzothiazole sulfenamide. No cracks in 239 hr.

UOP
UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road, Des Plaines, Illinois, U. S. A.
WHERE RESEARCH TODAY MEANS PROGRESS TOMORROW

capitol cues

YOUR FEDERAL INCOME TAXES WILL PROBABLY BE CUT next year, if current political and economic trends only persist. The U. S. Budget is getting into the best shape of any time since the end of World War II. Continuing good times are boosting profits and incomes--and the Treasury's revenue receipts. At the same time, according to recent surveys, members of Congress want to grant relief--once at least part of the huge federal debt has been paid off. What's more, if a recession should develop, cuts would help boost business.

Here's the way the black ink will be growing in coming years:
- In fiscal 1960, the year we are now in, the Budget should be just about balanced, with spending and outgo at $78.5 billion.
- In fiscal 1961, a surplus of around $3 billion is anticipated. U.S. spending will be up a little, revenue quite a bit more.
- The next year, fiscal 1962, the surplus could jump to around $7 to $8 billion, if business continues good. Receipts would be way up while Federal spending would again rise very little.

The 1962 federal budget will go to Congress early next January. And if a $7-$8 billion surplus is indicated, Congress will be ready to approve tax changes, in advance of actual surpluses.

Here's the way Congressmen think the cuts should be made:
- Individuals should be taken care of first. That's normal with Congressmen; they favor the voters and they have the idea that such cuts can stave off a recession. Cuts might be 10% or so.
- Corporations should get some relief, too, if the surplus turns out to be large enough. A cut from 52% to 50% might be voted.
- Manufacturers, also, might be given some relief on the excises they now pay, especially those approved during the Korean War. Cuts could reach $4-5 billion, with some left for debt payment.

THERE'S STILL A CHANCE FOR THE KEOGH BILL--to give the self-employed deductions for contributions to private pension plans. It passed the House last year. But the Senate has been hesitating because of Treasury dislike. Now the Treasury is ready to go along--if the program is modified some and cut down. This may be all that is needed finally to push the bill across.

A SHIFT TOWARD EASIER CREDIT MAY NOW BE UNDER WAY, judging from recent developments. The tightenings of recent years may at least be reaching an end. This does not mean that you will see a sudden easing in rates and the supply or that credit conditions will return to the ease of the early 1950's. Though the worst of the tightness may be behind us, coming changes will be slight.

There are four factors behind the shift that's now in process:
- The Budget surplus that is coming will act as a deflationary influence; the Treasury will take in more than it will spend.
- Recent business trends don't show the large expansion that was anticipated at the beginning of the year. Industrial output is leveling out while auto sales are not as high as hoped for.
- Commercial loans are not rising at the rate anticipated though it should be noted that they have begun to show some strength.

PRICE INCREASES THIS YEAR WILL BE MODERATE, in the view of government experts. Budget surpluses, competition, and prospects of business leveling are helping. Gains probably will be greater at the consumer level than at wholesale. Though the rises will be small over-all, they'll be widespread.

-At retail, gains may average a little more than 1%. Food won't go up at the 2% to 3% rate of recent years, while clothing will be costing about 1% more. Dealer discounts on new cars will hold prices down. But higher local taxes will boost prices on many items. Medical costs will rise.
-At wholesale, the price hikes will average a little under 1%, with farm products easing and metal products going up. A fall in home-building will keep building materials from rising over-all. Machinery prices, though, will increase.

The costs of services will continue to show 2% to 3% gains.

EXPANSION OF THE MINIMUM WAGE LAW WILL BE VOTED by Congress this year. But, there will be a big fight over how it will be done. The Democrats want to extend coverage to some 10 million more workers in retailing, in services, in local transit, and building trades. They also want to raise the minimum from $1 to $1.25 an hour. President Eisenhower and his advisers, however, favor a more moderate increase to, say, $1.10 an hour. And they would rather extend the coverage of the wage-hour laws to only a small number of workers.

In the end, Eisenhower's position probably will be the one that prevails. If any bill passes, it will provide for a compromise covering less than 5 million workers. And some exemptions may be made for firms grossing under $750,000.

NO CHANGES IN GOVERNMENT PATENTS POLICIES are likely to be approved by Congress this year. This will be disappointing news to many companies now working on U.S. contracts. They now have a few rights in inventions developed in fulfilling these jobs. But in many cases the title goes to the government, which will offer these patents, royalty-free, to all of American industry. What contractors want is private control, with only the U.S. having free use.

Senate antitrust leaders are reluctant to give industry the rights to patents without prior review by the Department of Justice and the National Science Foundation. Time will run out this session before a compromise can be reached. Patents on space, medical, and atomic energy contracts are involved.

THE JOB OUTLOOK FOR COLLEGE GRADUATES IS GOOD this year, probably the best ever. Both university officials and industry recruiters agree on this, on the basis of preliminary soundings that were conducted during the Spring. For one thing, demand is increasing. The federal government is aggressively seeking young technical and scientific workers--the ones industry wants most. As a result, the number recruited out of universities will rise 20% over '59.

Starting pay for engineers and scientists will be up by 6% this year, to around $490 a month. Graduates in business administration will be getting about 3% more. Though the recruiting by the federal establishment is currently being stepped up, starting salaries are 15% under industry's.

Developing an improved rubber product? check

Goodrich Gulf

As in the case of the new soling material below, Goodrich-Gulf can help you in product development. Since we produce the broadest range of SBR polymers, we have a wealth of technical data and know-how to share. If new testing is called for, our Customer Service Laboratory is staffed to dig in. And you'll find our technical service men experienced and resourceful. Product improvements mean sales—put Goodrich-Gulf service to work on your team!

Ameripol
THE PREFERRED RUBBER

They cracked a new market—This new soling material is enjoying spectacular sales in the quality, dress-shoe market. The exceptional appearance and smooth feel is achieved with a new rubber polymer—Ameripol 4600. Goodrich-Gulf technical men worked with the soling manufacturer in matching product requirements to polymer properties.

Goodrich-Gulf Chemicals, Inc.

1717 East Ninth Street, Cleveland 14, Ohio

How Ameripol Rubber

Non-staining — a prime requirement for erasers is to do the job quickly and cleanly. An Ameripol polymer noted for its clarity and uniformity was selected by this leading pencil manufacturer. The polymer is non-staining, won't leave marks on paper. And its properties permit easy processing in pastel colors—just right for erasers and other light colored products. *(photo below)*

Hold the cost line—The manufacturer of this rubber carpeting maintains high product quality, holds cost in line. He uses Ameripol 4700, a 50-part oil-extended rubber that cuts material costs nearly 10%, and reduces the amount of whitener needed in compounding. There may be similar cost savings possible to you by switching to a less expensive oil-extended SBR for molded and extruded goods.

Color stability—Ameripol 1502 is a uniform light colored rubber that requires only minimum pigment addition—thus making it easier to produce the bright yellow color required for airline ground crews. The rainwear has excellent color stability, and high resistance to staining and abrasion. *(photo at left)*

Ameripol
THE PREFERRED RUBBER

meets individual requirements

Luxury look—This rubber floor tile is produced with Ameripol 1502 in striking color and beauty—color that won't stain or fade in the sunlight. Since the polymer is consistently light and uniform, the manufacturer easily duplicates colors from one production run to the next. With Ameripol, the luxury look is achieved in a modestly priced product.

Flexing strength—This shoe is specially designed for sailors on wet and slippery decks. Its sole gives it perimeter traction action that grips tightly when the weight is shifted. An Ameripol polymer proved to have the excellent physical properties required; keeps its shape and strength through repeated flexing. The polymer is uniform and stable in processing.

Goodrich-Gulf Chemicals, Inc.

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you get preferred service from

Goodrich Gulf

Fast—Warehouses in Chicago, Akron, Newark, and Neosho, Missouri, backed by giant plants in Institute, West Virginia and Port Neches, Texas, are geared to give you quick service. Most rubber product manufacturers are within a 24-hour delivery range of Ameripol stocks.

Complete—You have the most complete selection of polymers available: non-pigmented hot, cold, and oil-extended types; micro-black masterbatch cold, and oil-extended types. Packaged in bales to suit your requirements; selected polymers available in crumb form.

Progressive—Extra values with Ameripol include technical assistance, packaging improvements to cut your handling costs, dependable quality to simplify your processing.
And Goodrich-Gulf's polymer development program helps you gain a competitive edge.

Ameripol
THE PREFERRED RUBBER

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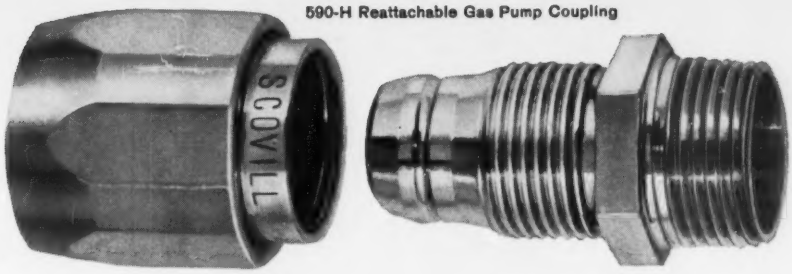
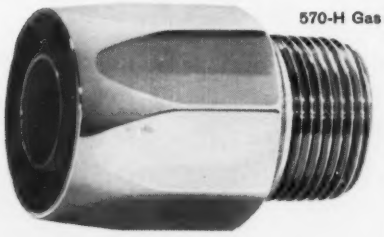
590-H Reattachable Gas Pump Coupling



HOSE COUPLINGS BY SCOVILL ANSWER ALL 3 VITAL QUESTIONS

520-H Fuel Oil Coupling, Permanently Attached

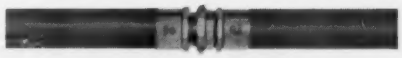
570-H Gas Pump Coupling, Permanently Attached



When you next specify fuel oil and gas pump couplings, ask yourself these 3 vital questions . . .

1 *Where can I get economical, dependable couplings?* Scovill was the first to design and manufacture couplings for modern hoses—and is, today, the nation's leading supplier of fuel oil and gas pump couplings. With Scovill couplings, you are assured top quality, trouble-free operation. Anchorage on Scovill couplings is positive and permanent (Scovill couplings are subjected to as many as 7,000,000 cycles in flexing tests without signs of failure!) Scovill ferrules are of high strength, cold drawn copper alloy with straight sides that parallel the body. They have rounded edges—will not snag on curb stones or shrubbery. And the retaining grooves in female section hold washer in place—prevents loss when coupling is disconnected!

2 *Where can I get immediate delivery?* Scovill maintains a wide range of strategically placed sales offices and warehouses. They stock a full line of all couplings—from ¾″ to 3″ in fuel oil couplings . . . and all standard sizes in gas pump couplings. Orders are processed and shipped without delay. 3 *Where can I get immediate service and expert advice?* Scovill has the largest—and the finest—sales and service force in the industry. They stand ready to consult with you wherever and whenever you wish. *For complete information, write: Scovill Manufacturing Company, Industrial Coupling Division, Waterbury 20, Conn.*



Hose couplings by **SCOVILL**

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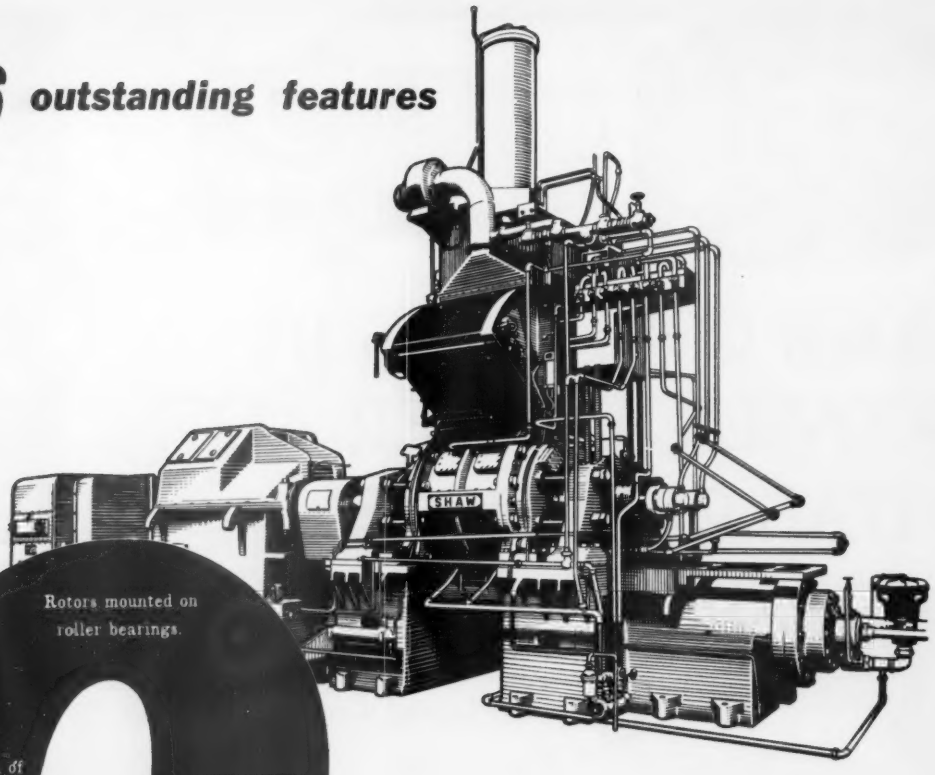
6 outstanding features



6

Rotors mounted on roller bearings.

Bi-metal construction of rotors for strength and wear.

Efficient temperature control over all contact surfaces.

Interlocking rotors for maximum mixing efficiency.

Easily renewable wear plates.

Cooling heating chambers inside rotor nogs.

the ONLY internal mixer with ALL these advantages

The SHAW INTERMIX has a high horse-powered drive with high pressure head giving fast, efficient mixing and also allows for the high temperature reclaiming of waste rubber.

SHAW INTERMIX

FULLY DETAILED LITERATURE ON ALL FRANCIS SHAW EQUIPMENT IS AVAILABLE.

Francis Shaw

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CONCENTRATION on synthetic rubber is the key to ASRC's scoring with a wide range of low Mooney polymers—including ASRC #3110 with the lowest Mooney in the market. And a low Mooney means less money in production costs for you. It's the ease of processing, through greatly reduced breakdown time, that gives you substantial savings in power and labor.

And, that's just one benefit you get from ASRC's concentration on synthetic rubber. There's also ASRC's unusual polymer uniformity, time after time, run after run. There's ASRC's dependable delivery that makes for easy production scheduling. There's the technical assistance ASRC's SBR-minded staff can give in solving your specific problems. *If you have a question, there's no question of what to do. Call on ASRC today!*

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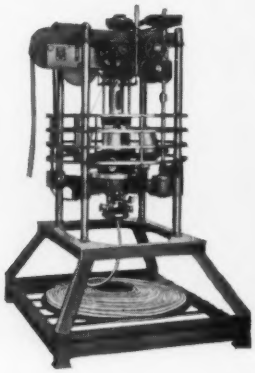
THE FIRST NAME IN SYNTHETIC RUBBER

New Lock Stitch* Reinforcement for Automotive and Industrial Hose at 1,000 FEET PER HOUR with the FIDELITY Vertical Knitter



Knit rayon, cotton, nylon — all natural or synthetic yarns on rubber hose extrusions in continuous lengths; at speeds up to 1,000 feet per hour. Fidelity's new *lock stitch* method of hose reinforcement assures the positive resistance to expansion under pressure, required for today's automobile radiator, windshield wiper, gasoline and heater hose, as well as other types of industrial rubber hose. Hose is strong *and* flexible, adhesion is better . . . diameters are uniform . . . expansion is restricted.

Electrically controlled Fidelity Hose Reinforcement Knitters are setting new standards for quality hose production *and* economy never before possible with conventional Braiding machines. The Fidelity method utilizing less floor space, completely eliminates costly rewinding, treating and drying operations . . . takes yarn direct from 10 pound cones—requires no special package.

Learn for yourself why Fidelity Hose Reinforcement Knitters have been the choice of the world's foremost Rubber and Plastic Hose Manufacturers for nearly 25 years. Write for Catalog HRA . . . or visit our Philadelphia showrooms and see a Fidelity in operation.

*Patented
U. S. Patent #2,788,804

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SILICONE NEWS from Dow Corning

Cut Rejects; Lower Costs!

CUTS REJECT RATE . . . giant tires release easily and surface details are perfect . . . no costly reject problem here thanks to heat-stable Dow Corning Silicones.

Dow Corning Silicone Mold Lubricants Assure Quick, Clean, Easy Unloading

Recent field reports indicate more and more tire molders are standardizing on Dow Corning silicone release agents to assure perfect performance every time. That means clean release without sticking; sharp surface details . . . tires that look their very best.

Economical to use, these silicone mold lubricants cut mold cleaning time down to almost nothing and at the same time increase mold service life, keep rejects to a minimum, and speed production. Applying Dow Corning silicone mold lubricants is a snap . . . spray into intricate grooves, or wipe onto smooth surfaces.

Whatever the fabrication problem—from releasing green tires to lubricating Bag-O-Matic bladders—there's a Dow Corning silicone lubricant that's effective, economical and easy-to-use. Available in different forms, too: water-dilutable emulsions, solvent soluble fluids, greaselike compounds, stable dispersions.

For the Rubber Industry . . . In other areas of the rubber industry too, Dow Corning Silicones have proved to be time and money savers—as electrical insulation for mill and mixer motors; as anti-adhesive coatings for bags, containers and interleaving; as heat-resistant paints that also resist weathering and corrosive atmospheres; as lubricants for ball bearings; and as Silastic® gums and bases for compounding silicone rubber stocks to meet severe requirements. Write for more information.

EASILY APPLIED . . . Dow Corning silicone mold lubricants can be sprayed easily to reach tiny openings, and assure clean, easy release.

You can't find better release agents for rubber and plastic products than Dow Corning Silicones. Get more facts now. Write Dept. 9205

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

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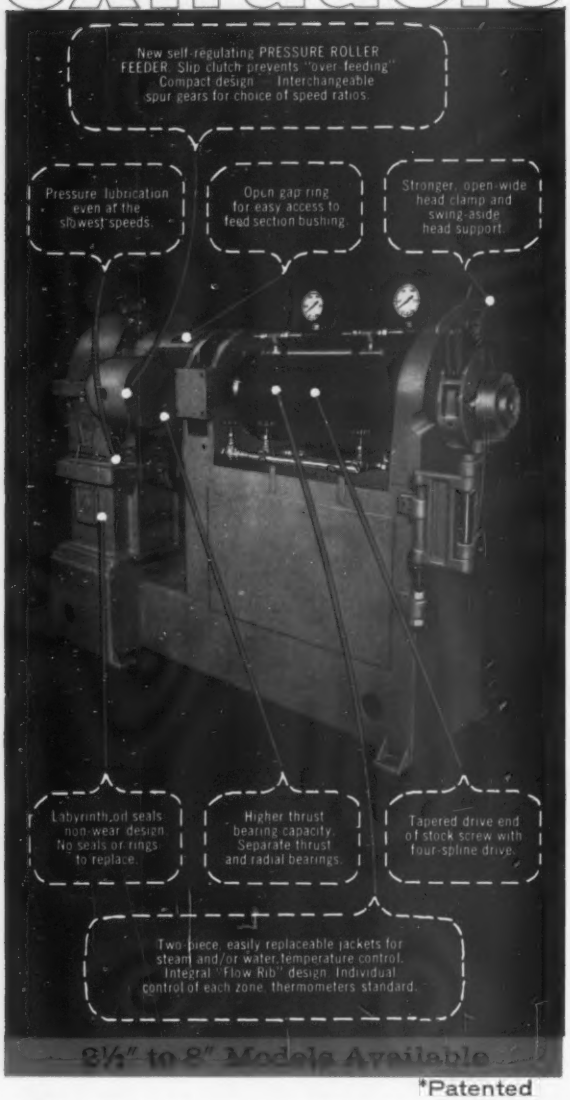
DAVIS-STANDARD

thermatic* Series

rubber extruders


New self-regulating PRESSURE ROLLER FEEDER. Slip clutch prevents "over-feeding". Compact design — Interchangeable spur gears for choice of speed ratios.
Pressure lubrication even at the slowest speeds.
Open gap ring for easy access to feed section bushing.
Stronger, open-wide head clamp and swing-aside head support.
Labyrinth-oil seals, non-wear design. No seals or rings to replace.
Higher thrust bearing capacity. Separate thrust and radial bearings.
Tapered drive end of stock screw with four-spline drive.
Two-piece, easily replaceable jackets for steam and/or water temperature control. Integral "Flow Rib" design. Individual control of each zone, thermometers standard.
8½" to 8" Models Available

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CALIFORNIA, OREGON and WASHINGTON — C-L Chemical Products Co., P.O. Box 3043, Santa Ana, California.

Overseas

Midlands—Plans for the construction of an 8 million pound per year synthetic rubber latex plant in the English Midlands, has been announced by Witco Chemical Co., Ltd., London, England. On-stream operations are due to begin in early 1961, and the output will be a complete line of butadiene-styrene, high styrene, nitrile and other acrylic latices.

Rouen—United Carbon France S.A., has begun initial plans to build a 50 million pound per year carbon black plant near Rouen in northern France.

El Palmar—The Department of Agriculture of Mexico plans to plant 600 hectares with rubber trees in El Palmar, Veracruz, Mexico. The department reports that if the first planting is successful, the plantation will be increased to 3,000 hectares. At present, 200 million pesos are being spent annually on raw rubber imports.

Grangemouth—British Hydrocarbon Chemicals will spend $14 million to build three plants at its Grangemouth, Scotland, petrochemical facility. One plant is designed to more than double the existing butadiene capacity. The other plants will produce methanol and ethylene dichloride, respectively. Startup is scheduled for 1961.

Paris—The Finance Ministry of France has announced a further substantial step toward the removal of quotas from imports. Under the new French measures, about 50 chemical products, as well as cement products, plywood panels, equipment for the rubber and plastics industries, and photographic supplies, will be freed from quota restrictions. The Finance Ministry is aiming for the abolition of import quotas by the end of 1961.

Arnhem—A substantial expansion of the synthetic rubber producing facilities of N.V. Chemische Industrie Aku-Goodrich (Ciago) at Arnhem, Netherlands, is now underway. The plant produces butadiene-styrene type latex, used in making foam rubber; high styrene reinforcing polymer, used mainly in shoe soles; and Hycar nitrile latex, which goes into a variety of products. The new facilities are expected to be completed by early 1961.

Melbourne—A new tire manufacturing plant in Melbourne, Australia, has been dedicated by B. F. Goodrich Australia, Pty., Ltd. Goodrich Australia is a partnership between Goodrich and Ampol Petroleum, Ltd. The plant began production in February, 1960.

Ask your Velsicol representative how to make **rubber tough, stable & more profitable**

Velsicol's X-30 and GD-5-28 Hydrocarbon Resins are both ideal softeners and tackifiers for synthetic rubber. X-30 HYDROCARBON RESINS used in white or light colored rubber products maintains resistance to ultra violet discoloration, keeps products light, fresh and appealing on display and in use.

GD-5-28 HYDROCARBON RESINS are perfect for the darker formulations for shoe soles and heels, hoses, fittings, wire insulations and many other uses.

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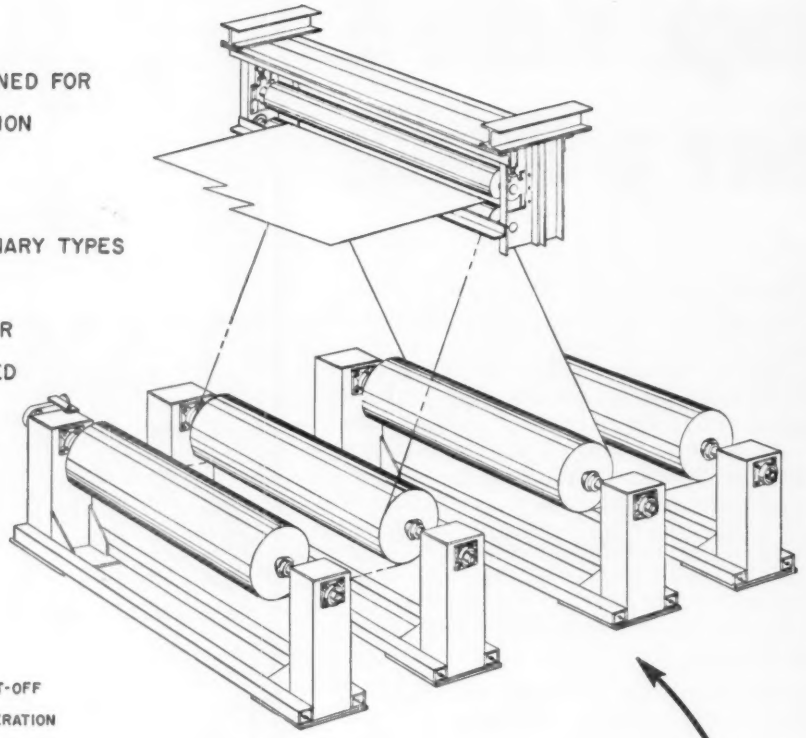

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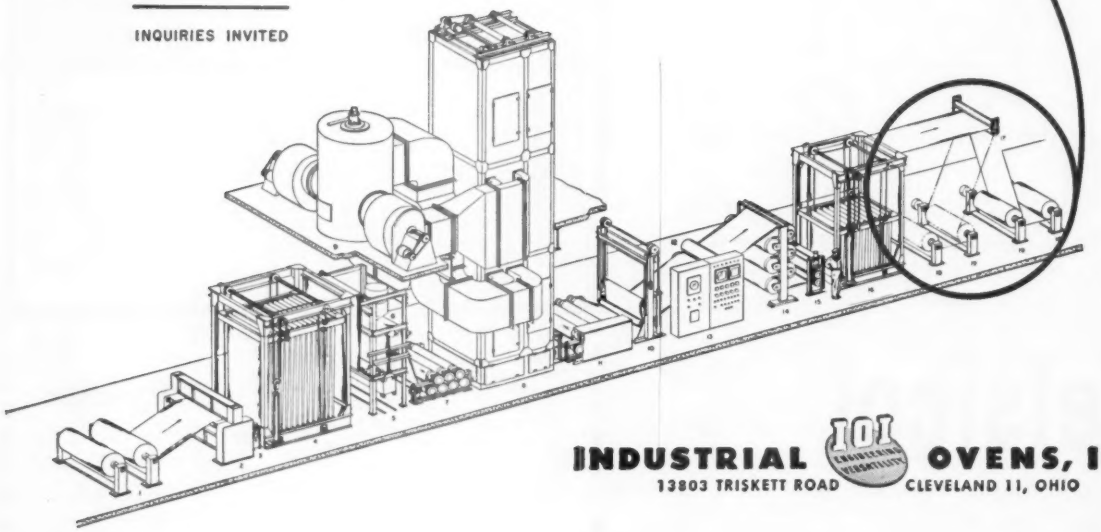

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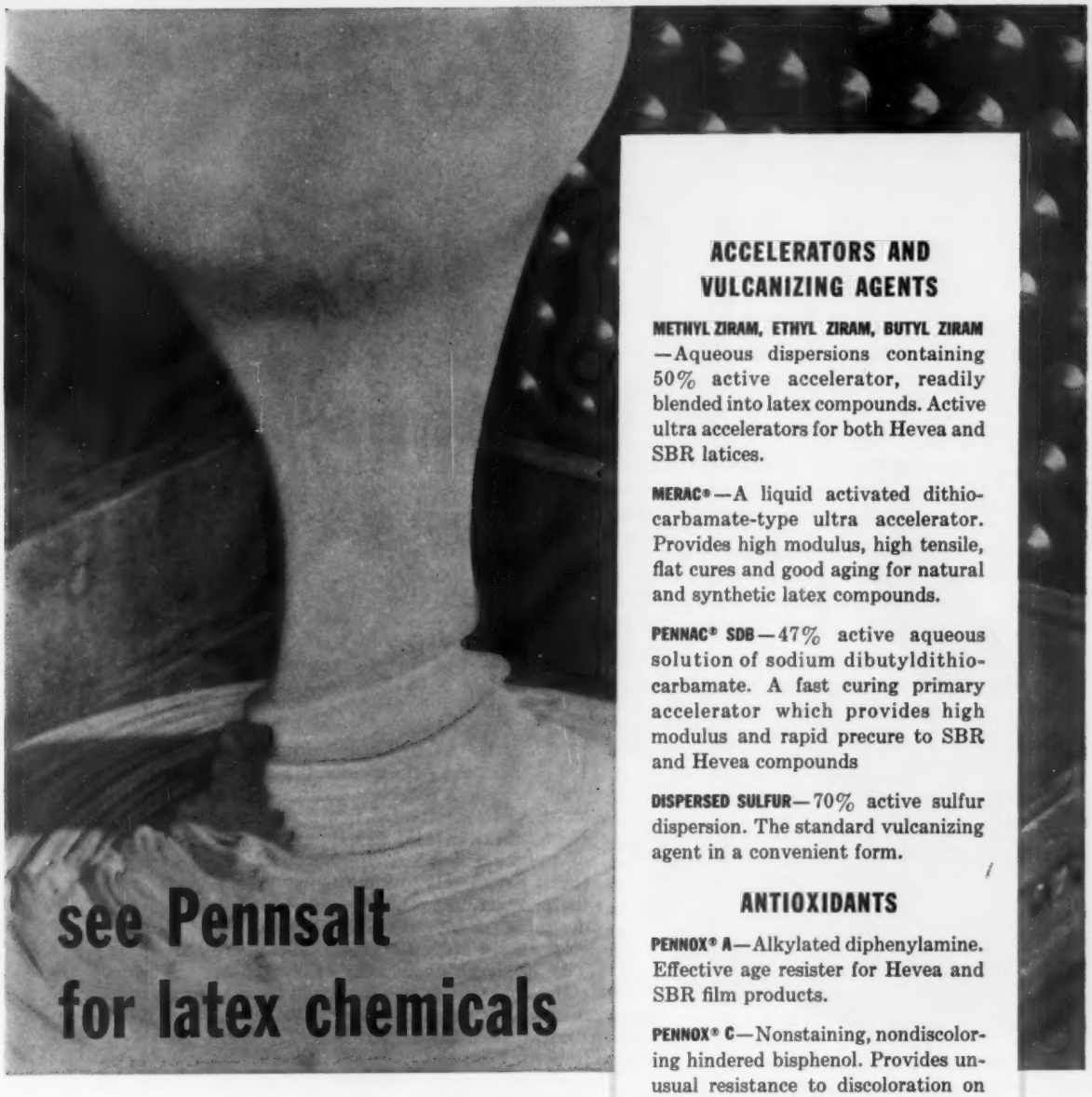

see Pennsalt for latex chemicals

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NEVILLE®

As Ken Soule Sees It

by Kenneth J. Soule

Rolling In Color

Raybestos-Manhattan, Inc. chose its annual stockholder's meeting as the occasion for the first public announcement and exhibition of a new line of pastel-colored bowling balls. The display and showing took place April 5 in the Music Room of the Biltmore Hotel, New York City.

Although Raybestos-Manhattan, through the Manhattan Rubber Division at Passaic, N. J. has made and marketed beautiful top-quality black and multi-colored (Paisley) bowling balls for years, their new product is breath-taking in its range of brilliant pastel shades. Included are seven rainbow colors, from which harmonious choices of two or three shades are selected for mottling against a pure white background. The result is spectacular, but not garish; eye-catching, yet pleasing to contemplate—in a word, a thing of beauty. To the best of my knowledge, such crisp, clean, lovely colors and such an alabaster white have never before been produced in a hard rubber suitable for rugged service similar to that which a bowling ball encounters. The technical and manufacturing staff at the Manhattan Division, (particularly Mr. Joseph N. Kuzmick, successively chemist, compounder, research coordinator, and now general manager) should be very proud of this outstanding scientific achievement!

At this point, some readers may say, "Interesting, but so what. Who needs or wants a ball such as you describe, even if it is a thing of beauty? What's wrong with one in black or with dark shades of mottling?" The answer, obviously, is that nothing is wrong with a standard color ball. But, if you want to give your spirits, and perhaps your score a boost, it might pay you to look at these new beauties. My uneducated guess is that the ladies (who have lifted bowling alleys out of the mud to their present sumptuous splendor) are going to go wild over them. Incidentally, several top male stars are said to have already entered orders for P.D.Q. delivery.

In any event, the addition of this much supplementary color to the already decorative modern bowling alley will help considerably to insure its continuance as a "many-splendored thing."

Fashion Note for Juniors

If you are a textile expert, or are definitely and specifically in the know regarding men's or boys' clothes, the ensuing is NOT for you. On the other hand, should you be an ordinary, run-of-the-mill ignoramus in such matters, we hope that what follows will be of value. In fact, we trust that it may help you on occasion to surprise your wife and growing son or sons with the extent and depth of your surprising *savoir faire* about what young Beau Brummels should wear.

Of course, we are at present a long way from Fall, but the fashion world is always at least a couple of jumps ahead of the calendar—as far as the actual seasons are concerned. Thus, in the boys' wear industry, the trend of fabric preferences expected for 1960 Fall clothes was determined at least two months ago. It ran something like this. Worsteds will be the No. 1 fabric, displacing flannels which have held the top spot for over ten years. (This upheaval, therefore, ranks in drama with last year's flop of the New York Yankees.) In addition, the push-up of worsteds stimulated activity in other materials, resulting in the rise of a relatively new fabric, hopsackings, into second place and pushing flannels into slot No. 3. (Again, just like the Yankees). Besides demonstrating once more that "uneasy lies the head that wears a crown," this cataclysmic change also proves that an unfancy name or humble background is not necessarily a handicap, even in the fashion world. For certainly the name Hopsacking, originally a material intended for rough bags to hold hops, is not steeped in glamour.

So, my friends, for what it is worth, there is the authentic dope on Fall fabrics for youngsters' clothes —right from the horse's mouth. The expert in question is Mr. Harvey E. Runner, staff authority on such matters for the *New York Herald Tribune*. If you find it desirable to quote him while putting on your own demonstration of "Father Knows Best," I am sure he would not mind. But if you prognosticate still further that both flannels and the flannel-clad Yankees will remain in third place for a year or so, better be a little careful. You could be right fabric-wise, but on the rest of the prediction: don't forget the reserve musclemen in Kansas City cold storage!

Golf and Wild-Life

The United States Golf Association a short time ago announced the perfection of a machine to insure a greater degree of uniformity in golf balls for tournament play. The gadget involved was developed by Arthur D. Little, Inc., Cambridge, Mass., at a cost of about $40,000, and apparently furnishes an accurate measure of the resiliency of balls tested. As described in the *New York Herald Tribune*, it "clocks the ball's speed before and after impact by an electric-eye device, and the ratio of the two speeds is used to calculate what physicists call the coefficient of restitution (resilience)." (Not having seen the machine or a drawing of it, it is somewhat less than clear how one measures the speed "before and after impact" of a ball which started at rest—but perhaps something vital was omitted from the description.)

One thing in the *Tribune* article which gave me a momentary thrill was the headline "Machine Takes 'Rabbit' Out of Golf Balls." In my mind's eye, I immediately saw a little wild bunny hopping hurriedly from the open fairway and taking refuge in the high grass and shrubbery bordering the golf course. A golf ball with "rabbit" in it must therefore refer to the perverse tendency which so many duffer-hit balls have of dashing off the smooth green open spaces and hiding

As Ken Soule Sees It (Cont'd)

in the weeds, woods, or underbrush. Heaven be praised, I thought, good, old science has come to our rescue and perfected a golf ball which neither hooks, nor slices, but zooms straight ahead on its appointed path.

Alas, and alack! Further investigation showed that when the U.S.G.A. talked of taking the "rabbit" out of golf balls, they merely meant removing the extra yardage being built into the pellets by certain manufacturers. So the net result of this latest test machine will ultimately be to produce a standardized golf ball—probably with a somewhat reduced range. This no doubt is important in the highly competitive professional tournament field. But, for the run-of-the-mill hackers, why doesn't the U.S.G.A. sponsor the development of a ball with built-in stabilizers to keep it on the straight-and-narrow, thus leaving the rough for cute, little, undisturbed, mama, papa, and baby bunnies?

Calling Balls and Strikes

Although most baseball fans and a considerable number of players might question it, big league umpires lead rather hectic and unenviable lives—at least when they are working at their regular jobs. To be sure, the hours are not too long, the pay is quite good, the action all takes place in the open air and his "nibs" is absolute boss of the complete game, including everyone in it.

However, on the debit side consider especially the umpire at home plate. His lot is particularly unhappy, due to his necessarily close proximity to the catcher. This post requires almost super human dexterity and finesse if jostling and being stepped on by said receiver is to be avoided. Even worse, foul tips are a constant source of danger to plate umpires, as are wild pitches which elude the catcher but ricochet off the umpire's unprotected person. And, of course, the applause and gleeful shouts of callous fans when an umpire gets "pinked" by one of these errant spheres, is not exactly Balm of Gilead to his gentle spirit. In addition, it is almost axiomatic that no one loves an umpire—right or wrong he is never right to the biased, loud-mouthed fan—and when he does make a popular decision no one bothers to applaud. A tough set-up, calculated to produce Umpirical Ulcers.

In view of this touching situation, we are happy to report that one small, kindly gesture is being undertaken on behalf of these down-trodden arbiters of our national pastime. The action originates with the Chicago White Sox, which (if anyone is interested) just happens to have been *my* favorite team for a long time. Anyhow, the Sox are reported to be installing two automatic devices near home plate in Comiskey Park, which should make life easier and less embarrassing for the home plate umpires there, beginning with the Red Sox series starting May 17. One gadget is known as a ball popper, which lobs one or more balls to the pitcher when the "ump" pushes a button. This also eliminates his usual need for carrying four or five baseballs in the pockets of his jacket. The other device is an automatic brusher-offer for home plate. This will do away with the official whisk broom, and the unseemly and ungraceful upending indulged in by all home plate umpires at frequent intervals. Maybe, just maybe, if he can remain upright all the time, his nibs can start calling the corner pitches against our opponents a little better. It seems to me we rate it!

Golden Anniversary

A ceremony took place on April 9, 1960, at the General Meeting of the American Chemical Society, Cleveland, Ohio, which was of more than passing interest to the members of the rubber industry. At that time, 71 persons were presented with certificates honoring them for 50 years of continuous A.C.S. membership. Among them was one of our most distinguished and beloved associates, Dr. Harry L. Fisher.

As many of you know, "Doc" Fisher was directly connected with our industry (at Goodrich and U.S. Rubber) for some 17 years, and less directly (at Air Reduction and U.S. Industrial Chemicals) for another 21 years. He has also taught at Cornell, Columbia University, and University of Southern California—for a total of ten years. In addition, he has served as president of the American Chemical Society, and chairman of the Rubber Division. He was organizing secretary of the 12th International Congress Pure and Applied Chemistry; arranging secretary 16th Conference, New York City; administrative assistant of the Chemical Division, National Research Council; and a member of the Technical Synthetic Rubber Division, Reconstruction Finance Corp. He has written several books on rubber and allied subjects, and has numerous patents to his credit. He has been honored with the Goodyear Medal and the Modern Pioneers award. Incidentally, he has also always found time to be considerate, kind and helpful to everyone with whom he came in contact. Which may partially explain why he has such a myriad of friends and admirers, both here and abroad.

Although some 60 per cent of the 71 fellow members in the 50-year-club mentioned above are "retired," "Doc" Fisher doesn't seem to feel any urge in that direction. Since 1957, he has been Western technical director of Ocean Minerals, Inc., Los Angeles, Calif. I do not know what chemicals they produce, but in view of this marine tie-in, as well as his unusually broad training and experience, perhaps our transplated Easterner could come to the aid of the beleagured oyster growers in Long Island Sound. According to all accounts, the wily starfish is wreaking havoc in the oyster beds there, and so far no one has come up with any effective method of keeping them under control.

In your spare time, Harry, how about lending a hand? The oyster farmers, and us Blue Point lovers, would be mighty grateful for your help.

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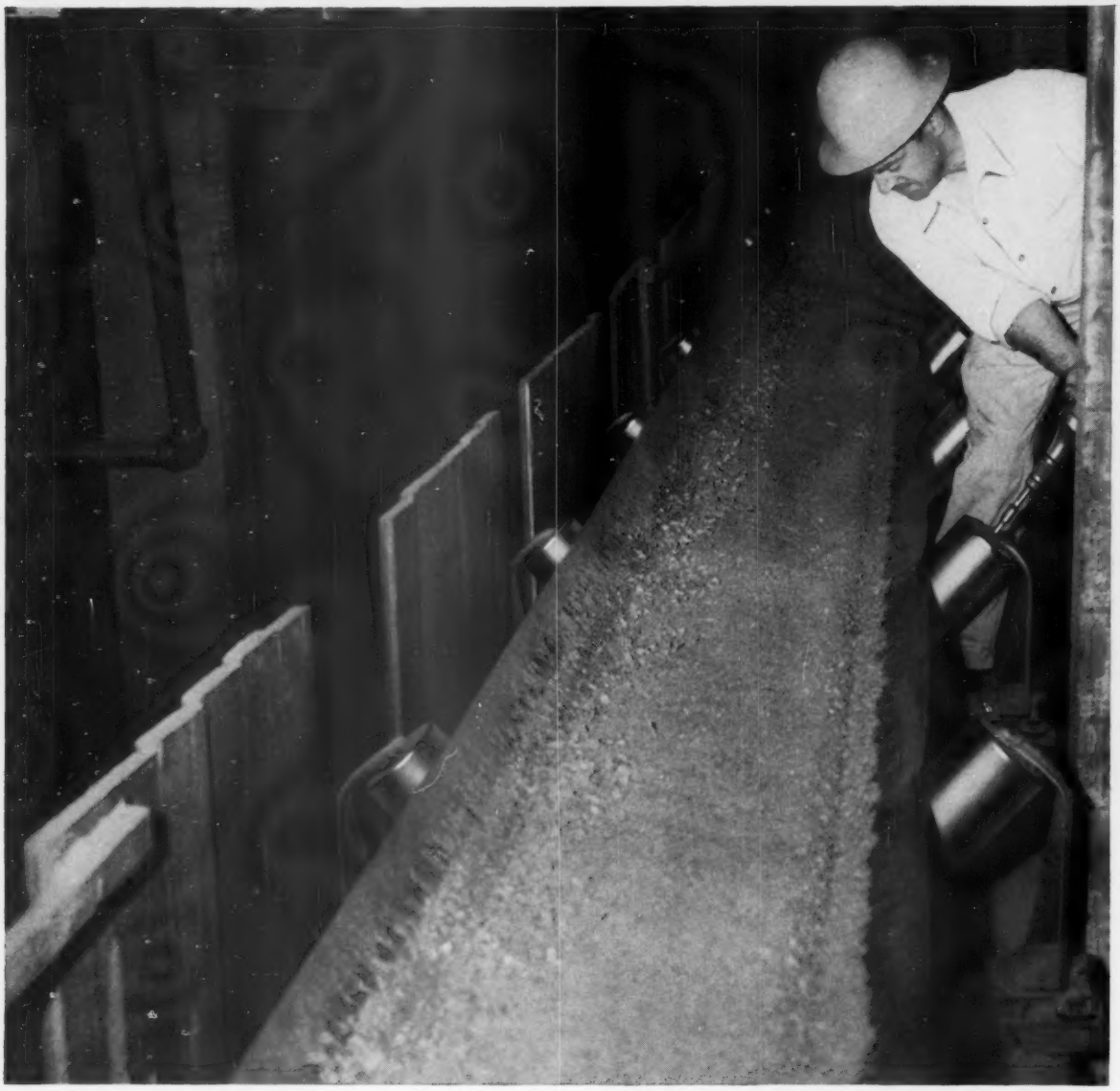

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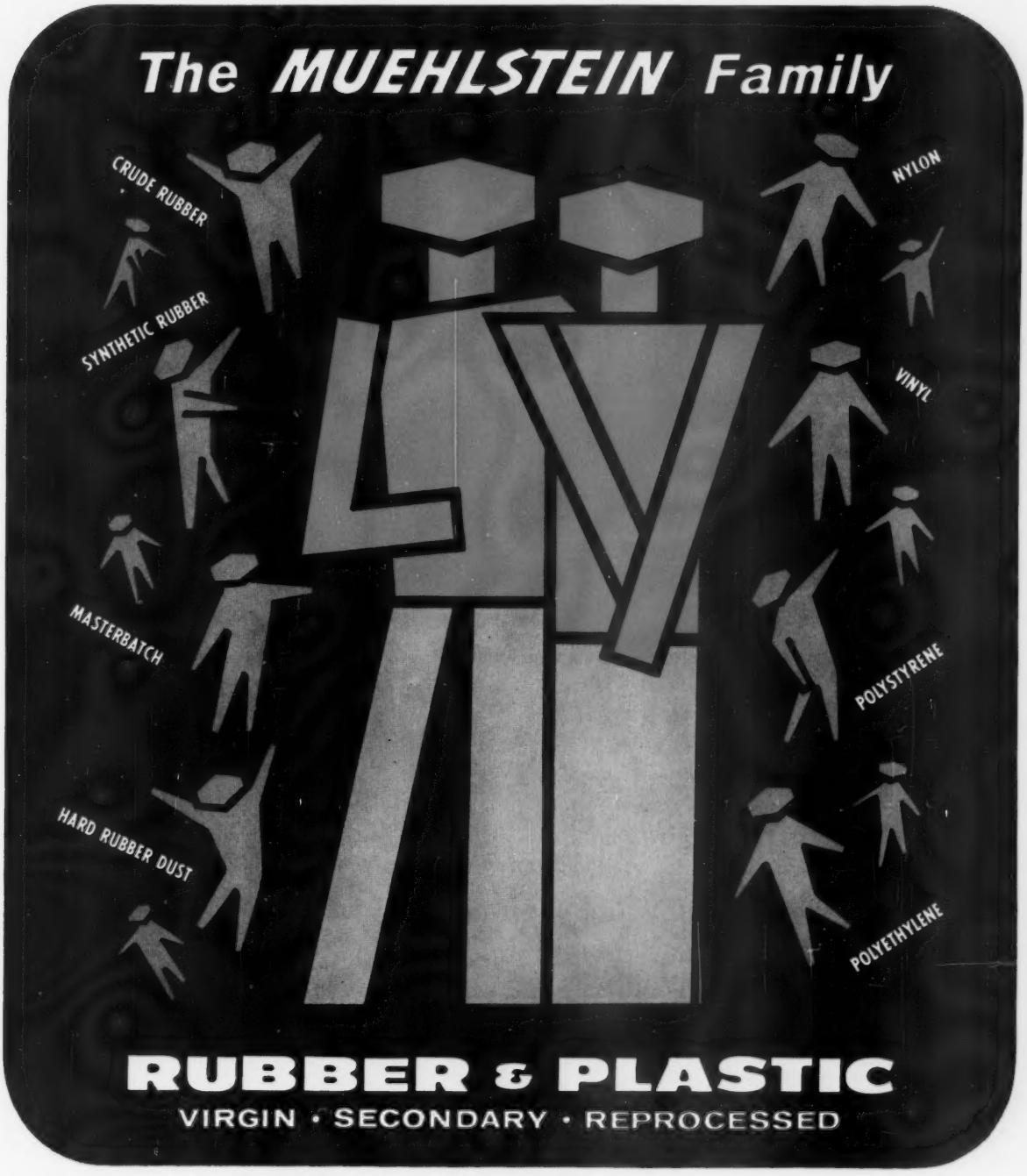

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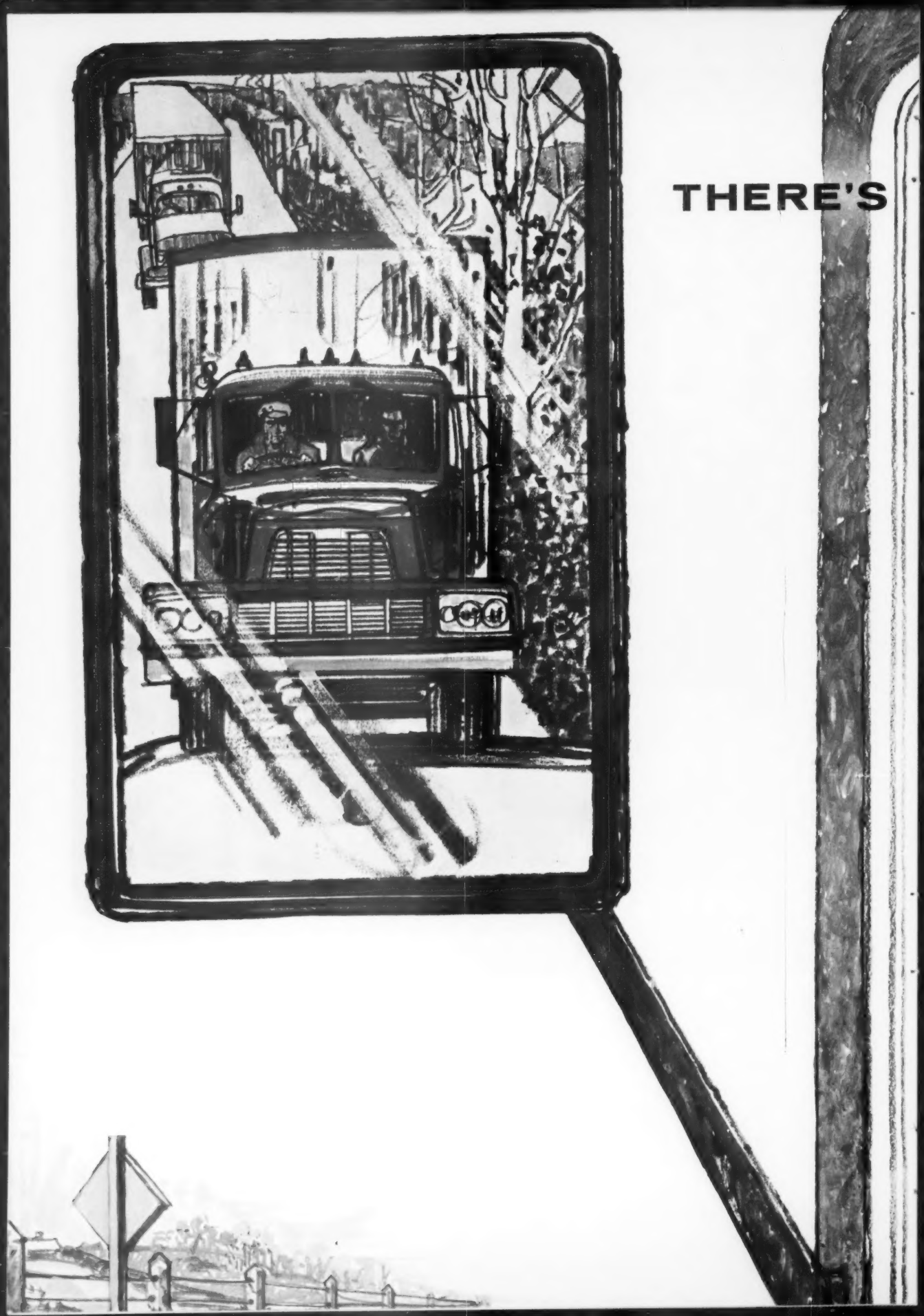
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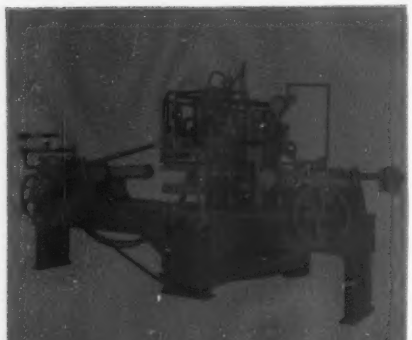

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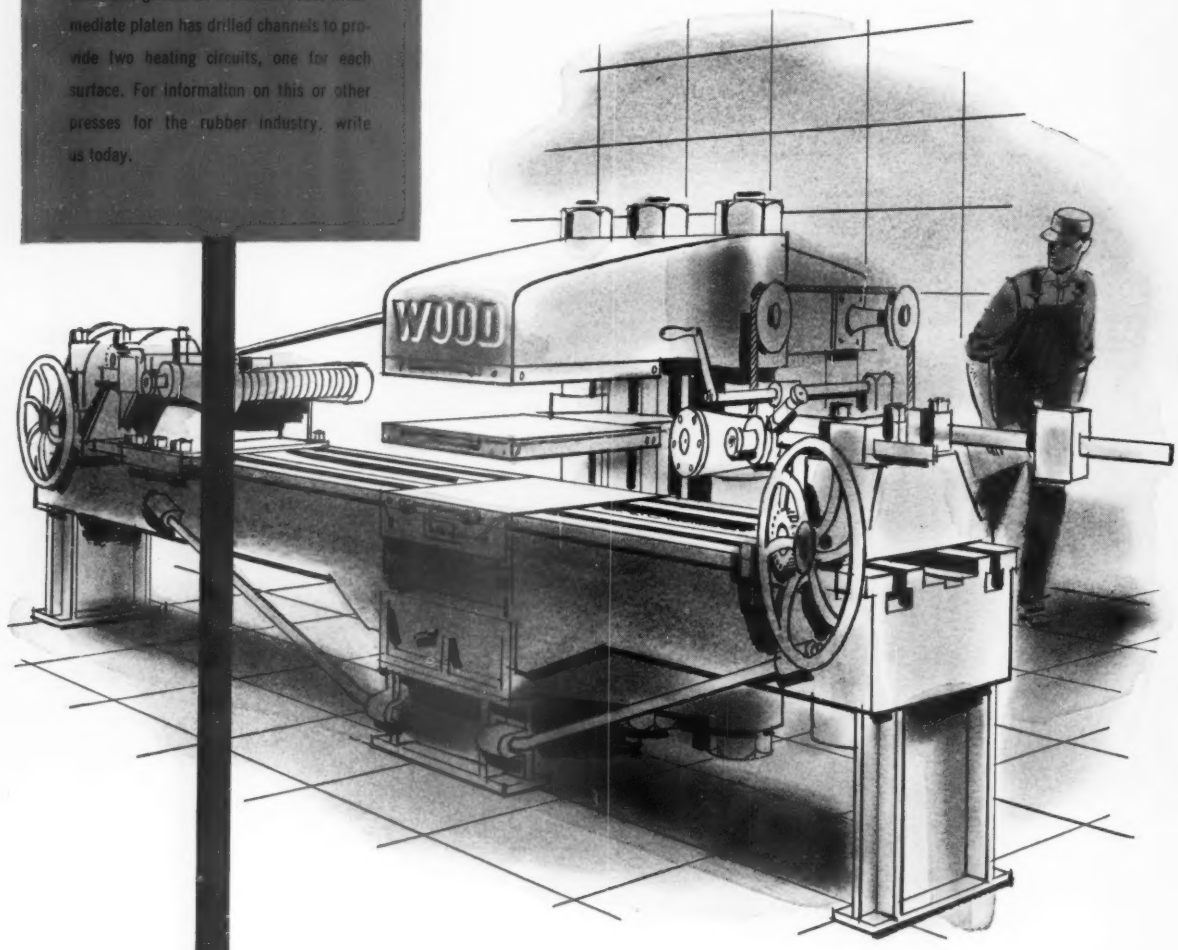

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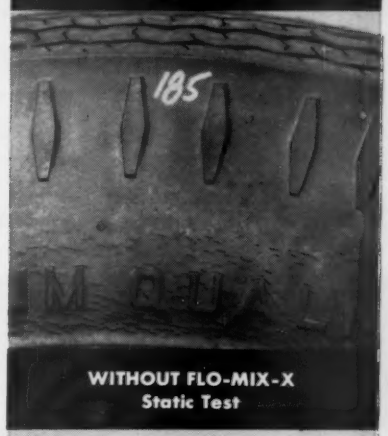

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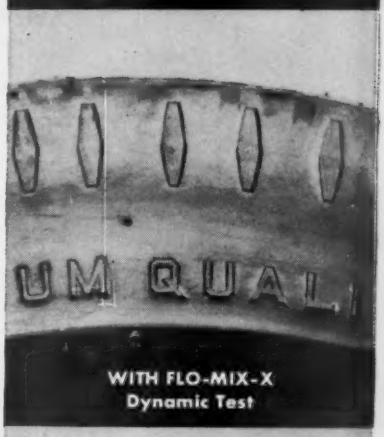
Static Test



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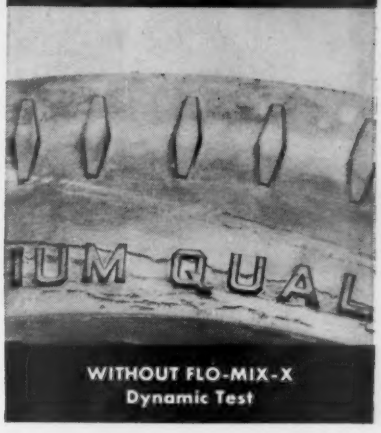

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contains facts and figures which show RECLAIMATOR rubber should be in your compound.

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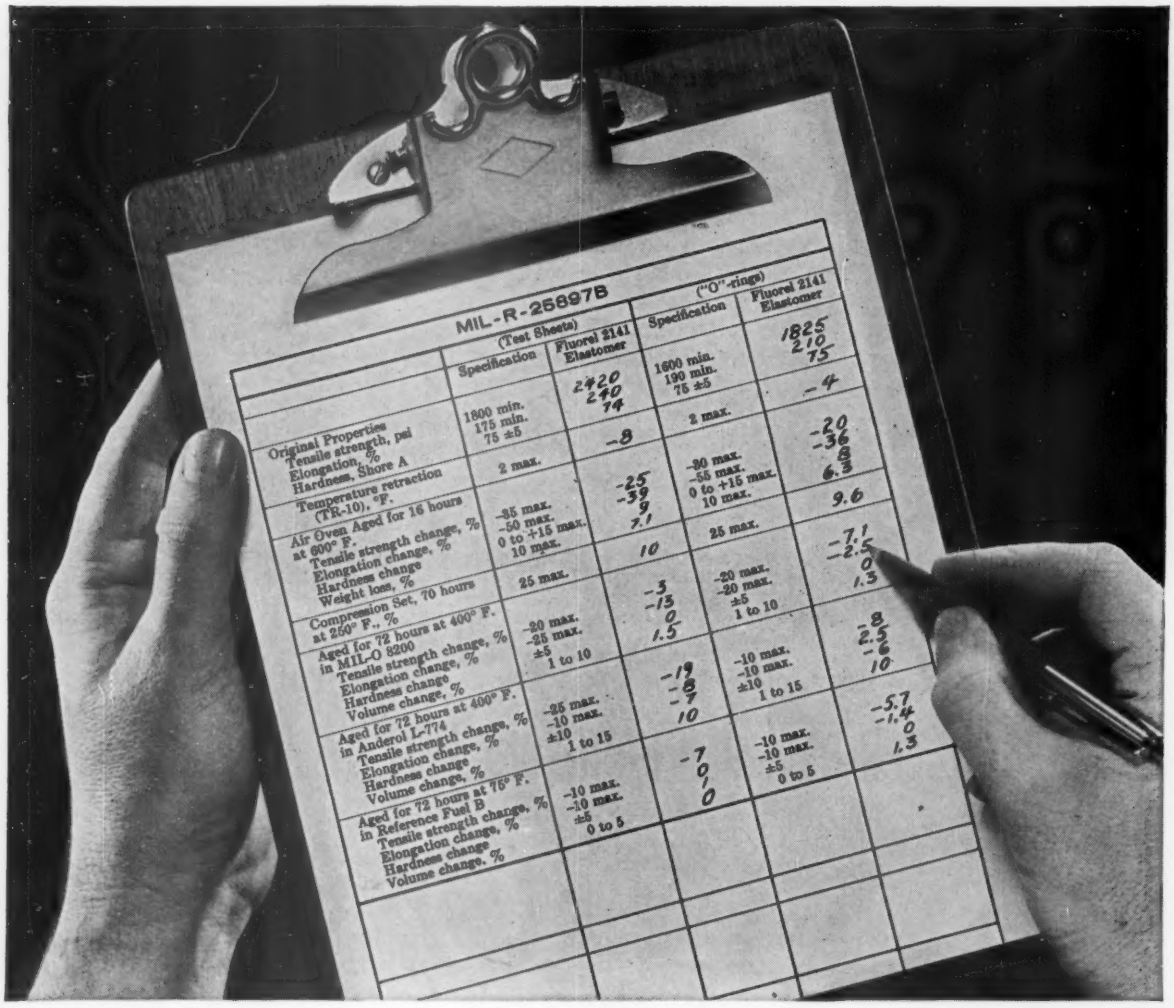

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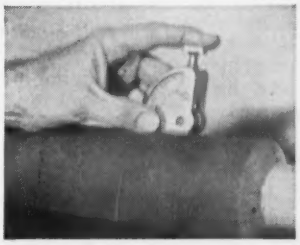
FURA-TONE® Brand Resin NC-1008 added to neoprene compound ignition cable jackets made by Belden Manufacturing Company, almost eliminates corona cracking, as seen in this comparison of two types of jackets. The FURA-TONE NC-1008 compound cut raw materials cost by as much as 8%, reduced scrap waste by 50%, improved processing.



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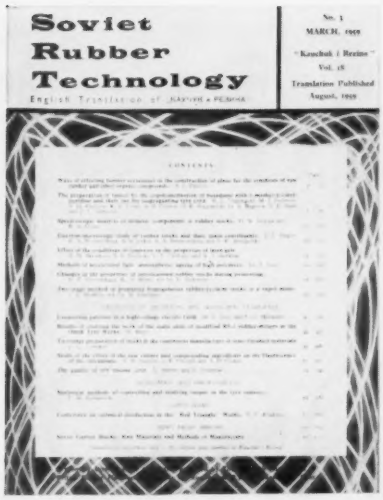

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A cover-to-cover translation of the monthly Russian rubber journal, "Kauchuk i Rezina". Prepared by the Research Association of British Rubber Manufacturers, in collaboration with Maclaren and Sons, Ltd. Distributed exclusively by Rubber Age in the Western Hemisphere. Deals with the efficient use of raw material, the automation of manufacturing processes in the rubber industry and improvements to the design of tires and industrial rubber goods. Articles describing the most important chemical research of interest to the rubber industry are also included.

Although it has been obvious in recent years that Soviet rubber technology and research is very vigorous and highly advanced, it has been extremely difficult because of the language barrier for those in Western countries to follow the technical progress being made there. This, in spite of the fact that the Russian rubber journal is a prolific source of original literature on the subject.

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The compatibility of polyisoprene with other types of rubber and the effect of this compatibility on bond strength.
Efficiency of the zinc salt and disulfide of trichlorthiophenol in reclaiming rubbers by the neutral method.
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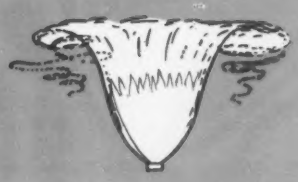

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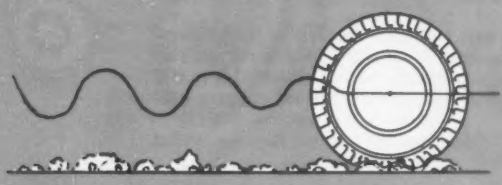
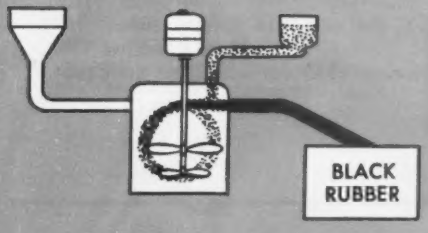
. . . an oil furnace black in the HAF fineness range with lowered carbon structure. NEOTEX 100 develops normal modulus as opposed to the high modulus characteristic of oil furnace carbons . . . produces compounded physical properties comparable to channel black . . . with a cure rate similar to furnace carbons. NEOTEX 100 was created for use in such products as carcass stocks, off the road tire treads and high grade mechanicals.



NEOTEX 130

. . . an oil furnace black in the ISAF fineness range . . . which also produces normal modulus. NEOTEX 130 develops good tensiles, high elongation and lower Shore Hardness . . . properties which may be utilized in passenger treads to provide improved ride and low noise while maintaining a good wear level. NEOTEX 130 may also be used to replace some usage of ISAF and channel to obtain improved properties in natural rubber truck and passenger tire applications.



NEOTEX 150

. . . an oil furnace black in the SAF fineness range with lowered carbon structure. NEOTEX 150 produces the highest tensiles of all available rubber carbons . . . makes possible normal modulus, high elongations and lower Shore Hardness compounds. These properties, in passenger treads, give the best combination of ride, low noise and tread wear. NEOTEX 150 is the tailor made carbon for the Black Rubber process.

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THE CASE OF THE
MOANING MUMBLER
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SORRY, DEAR, BUT... WELL... THE BOSS SAYS I'VE GOT TO FIND AN ANSWER TO OUR SOLVENT CONTAMINATION PROBLEM.. ...OR ELSE!!
ALMOST MORNING... MIGHT AS WELL STAY UP. GOTTA FIGURE OUT THE ANSWER!!
HM-M-M THIS AD SAYS SKELLYSOLVE IS CHECKED DURING PRODUCTION AND BEFORE SHIPMENT...
...AND IT SAID NINE OUT OF TEN CARS ARE SHIPPED THE DAY AFTER THE ORDER IS RECEIVED! I'M GONNA CALL THEM TODAY!!
...WHAT'S MORE, SKELLYSOLVE TECHNICAL SERVICE IS BACKED BY OVER 25 YEARS' EXPERIENCE...
SAY NO MORE... I'M SOLD ON SKELLYSOLVE!!
PURCHASING AGENT
...AND YOU SHOULD HAVE HEARD THE BOSS BRAG ABOUT ME FOR RECOMMENDING SKELLYSOLVE... JUST BEFORE HE ANNOUNCED MY PROMOTION!!
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NAUGATUCK

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4-WAY ANTIOZONANT COMPARISON

NO ANTIOZONANT

ANTIOZONANT–X-3.0 pph

ANTIOZONANT–Y-1.7 pph

FLEXZONE 3-C–1.7 pph

TEST CONDITIONS: Vehicle Test, Los Angeles–12,500 Miles

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- **Oxygen**
- **Flex fatigue**
- **Heat**
- **Copper poisoning**

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In *heavy-service nylon truck tires* Flexzone 3-C is the most effective inhibitor of groove cracking and cut growth.

Flexzone 3-C is

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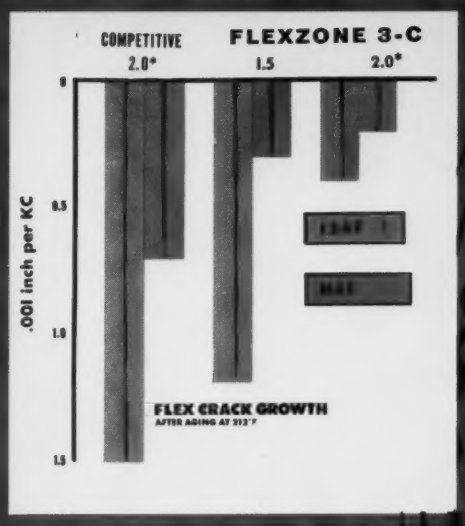

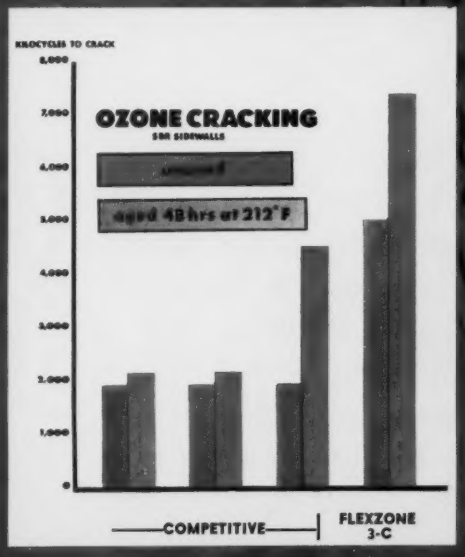

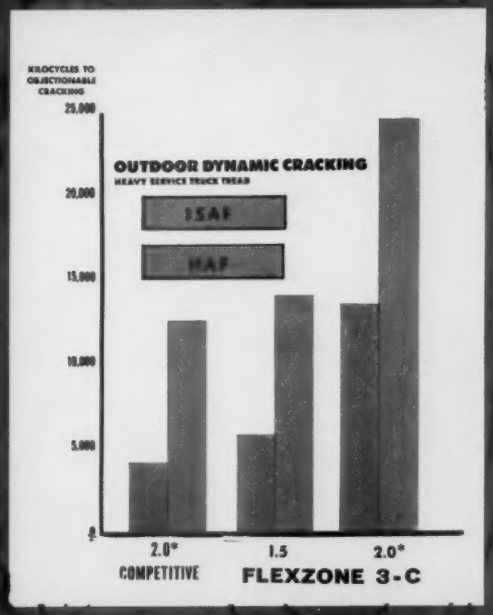

The above comparisons are made against materials classed as true antiozonants and not simply standard antioxidants.
*These contain 1.6 parts additional antioxidants.

The most effective antiozonant-antioxidant ever developed...triples a tire's flex life

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Division of United States Rubber Company

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Control Center — Calendar Treating Line. Photo courtesy Armstrong Rubber Manufacturing Co.

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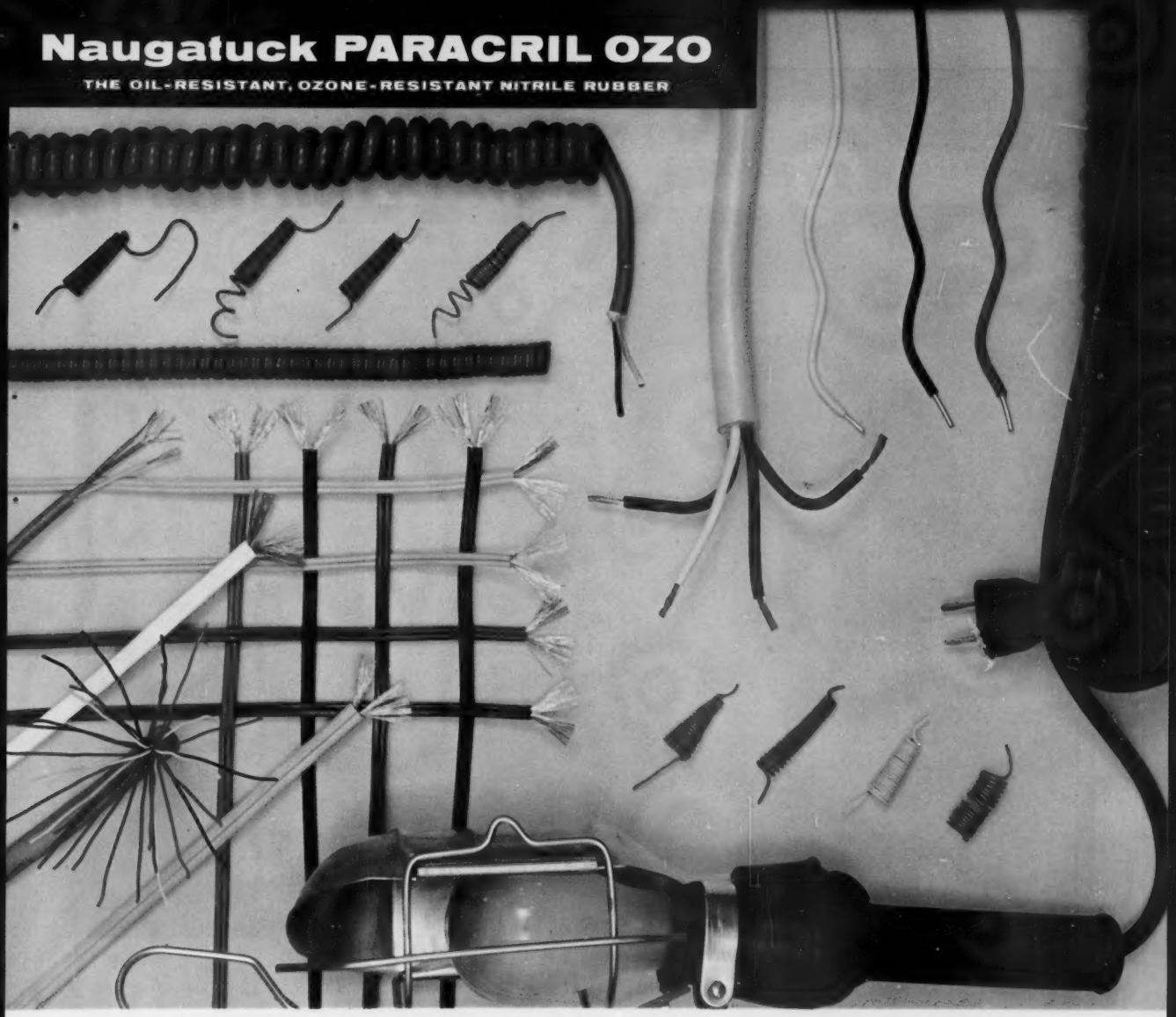

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X-ray diffraction comparison of Radiation Damage in Rubbers

Resistance of vulcanizates to chain-cleaving radiation damage shows a marked rise with special additives.

By W. E. SHELBERG and L. H. GEVANTMAN
U.S. Naval Radiological Defense Laboratory
San Francisco 24, Calif.

THIS PAPER describes the use of an X-ray diffraction technique to correlate rubber radiation damage with rubber composition. Correlations between radiation damage and composition are useful as guides for the development of superior radiation resistant elastomers to be used as components of mechanical devices installed in high nuclear radiation fields.

Rubber which is stretched and irradiated in an inert atmosphere is readily damaged by chain cleavage, manifested by loss of crystallinity, possible thinning, decreased X-ray diffraction intensities and eventual rupture (Figure 1) *(1)*. Loss of diffraction spot intensity was used to measure radiation damage in stretched rubber, and was tantamount to loss of crystallinity with little specimen thinning until just before rupture. Crystalline longevity was determined for an irradiated "standard" rubber under standardized conditions and for other rubbers which were similar to the standard except for an added or substituted ingredient. A greater crystalline longevity connoted a greater radiation resistance, and the standard was used as a basis for comparing radiation resistance and composition.

The experimental work consisted of: firstly, stretching thin strips of rubber specimens 400 per cent and maintaining them immobile, mounted on a special holder; secondly, exposing them in a nitrogen atmosphere to a high irradiance of gamma rays from a kilocurie Cobalt-60 source; and, lastly, periodically assessing the decrease in diffraction intensities with a Geiger counting X-ray spectrometer (General Electric Co. XRD-3).

Preparation of Rubber Specimens

Table I gives the recipes for the three categories of mill-mixed rubbers studied: standard, graphite and additive. The graphite rubber was similar to the standard except that graphite replaced the carbon. Seven varieties of additive rubber were used, and each was made by incorporating 5 parts of a different, potential anti-radiation additive into the standard recipe. Rubbers were cured for 20 minutes at 250° F. in a tensile mold conforming to ASTM Designation D15-57T, except that the cavity depth was modified to 12 mils by milling the edges.

Hypothetically, a successful anti-radiation additive protects its substrate because the harmful radiation energy absorbed by the substrate is transferred to the additive which dissipates it in a manner harmless to the substrate. The intermolecularly excited additive may dissipate this energy directly as heat or by re-radiation, or indirectly through metathetical reactions

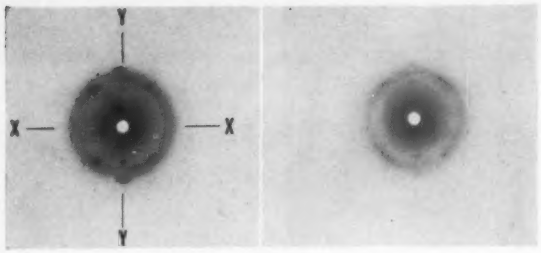
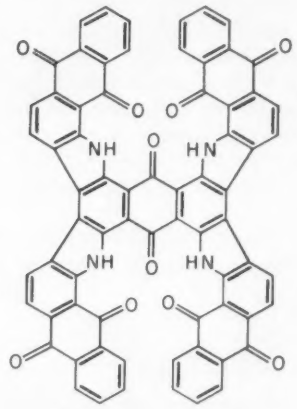


FIG. 1—Before and after a nearly rupturing dose: X-ray diagrams of a stretched rubber vulcanizate show loss of diffraction intensities upon irradiation. When rubber specimens were positioned on the goniometer of the X-ray diffraction unit with their direction of stretch horizontal, the Geiger counter scanned the amorphous halo along the left hand side of the X axis shown in the pre-irradiation pinhole diagram (left). With the direction of stretch vertical, the counter scanned the upper diffraction spots and the halo between them along the Y axis.

or decomposition. Resonant additives or polymer groups seem attractive as anti-radiation protectants. For example, resonant benzene decreases radiation damage of cyclohexane when mixed with it *(2)*, and the phenyl groups in polystyrene confer excellent radiation stability to the polymer *(3)*. When some part of the resonant anti-radiation additive becomes excited, the excitation energy becomes generally distributed immediately within the molecule. It would seem to be of advantage to have the energy distributed maximally over a large additive molecule, so that its subsequent, generally distributed de-excitation would be less likely to damage some particular bond in the substrate.

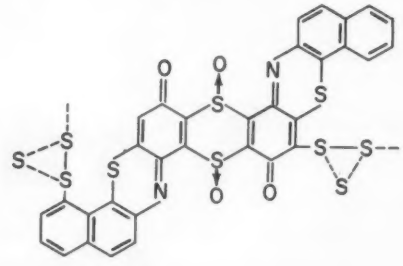
The particular additives used were selected on the basis of chemical structures actually or potentially capable of protecting against radiation. N-cyclohexyl-N'-phenyl-p-phenylenediamine was included because Born reported that it substantially improves the retention of tensile strength and ultimate elongation during irradiation of **un**stretched rubber *(4)*. Didodecyl selenide was selected since Carroll, Bolt and Calish noted that it retards radiation damage in lubricating oils *(5)*. Graphite was chosen because of its radiation stability which, it was thought, might be transmitted to the rubber. Copper phthalocyanine and phthalocyanine were picked for their resonance coupled with large molecular size, as well as their chemical, thermal and radiation stabilities *(6)* which, it was believed, might confer radiation stability to the rubber. The dye, Carbanthrene Khaki 2G, (I) was selected because of resonance coupled with large molecular size *(7)*.



Formula I

The sulfur dyes, Indocarbon CL and Immedial New Blue (II and III, respectively), were selected because of their resonance and sulfur side chains *(8 and 9)*. It was thought that vulcanization might combine these dyes with rubber molecules via sulfur bonds. In this event, successful anti-radiation protection would be hypothesized as due to **intra**molecular transfer and degradation of absorbed radiation energy.

Formula II



Formula III

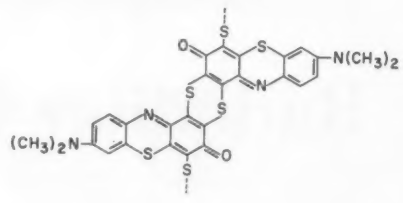


TABLE I—RUBBER RECIPES

Ingredient	Standard Rubber	Graphite Rubber	Additive Rubbers**
Deproteinized pale crepe	100.00	100.00	100.00
Sulfur	2.00	2.00	2.00
Zinc oxide (Prontox 166)	3.00	3.00	3.00
Zinc dibutyl-dithiocarbamate	0.25	0.25	0.25
2-Mercaptobenzothiazole	0.40	0.40	0.40
Graphite *	——	50.00	——
Carbon (Thermax)	50.00	——	50.00
Potential antiradiation additive**	——	——	5.00

* The graphite used was Graphite 509 (Asbury Graphite Mills, Asbury, N. J.).

** Seven additive rubbers were used, each containing one of the following additives: N-cyclohexyl-N'-phenyl-p-phenylenediamine (Antiox 4010, Naftone Inc., N. Y.); copper phthalocyanine (E. I. du Pont de Nemours and Co., Palo Alto, Calif.); phthalocyanine (Monastral Fast Blue 2G, DuPont); didodecyl selenide (Oronite OLOA 250, Oronite Chem. Co., San Francisco, Calif.); Carbanthrene Khaki 2G (325 mesh, Allied Chemical and Dye Corp., N. Y.); Indocarbon CLGS CONC CF (General Dyestuff Corp., N. Y.); Immedial New Blue FBLA Extra CONC CF (General Dyestuff). The Indocarbon and Immedial New Blue dyes contained sodium chloride which was removed by water washing.

Specifications of Test Device

The rubber specimens were stretched on a sample holder which consisted of a base plate, stretching clamps, a top plate and an inert gas well. Front and rear exploded views are shown in Figure 2.

The base plate (A) consisted of a modified stainless steel block, 4-23/32 in. long, 3⅛ in. wide and 15/32 in. thick. A circular well (a) of 1-17/64 in. diameter and 5/16 in. depth was drilled in the center of one face of the block, and this face became thereby the front face of the sample holder. A second circular well (b) of ¾ in. diameter and 1/16 in. depth was drilled in the center of the larger well (a). A 1.15 cm square aperture (c) with sides parallel to those of the block was cut in the center of the small well (b). Other features of the base plate were: ⅛ in. tapped holes (d) for attaching the top plate (C) to the rear face; dowel pins (e and f) of ⅛ in. diameter and height for reproducibly attaching the top plate; ⅛ in. tapped holes (g) for securing the inert gas well (D) within the large well (a); holes (h) for attaching the sample holder when completely assembled to the yoke-disc of the Geiger counting apparatus (Figure 4); ¼ in. tapped holes (i) for attaching the stretching clamps; and scribed lines (s) on the rear face for exact centering of the rubber specimen to be stretched, each line parallel to and ⅞ in. from a long-edge of the base plate.

The stainless steel stretching clamps were made as shown by (B). Each clamp consisted of two side posts (j); binding screws (k); top bar (l); compression screws (m); and press bar (n). The threadless side posts were ¾ in. long, ½ in. O.D. and 17/64 in. I.D. The Allen head, ¼ in. binding screws (k) penetrated the side posts, matched holes (i) in the base plate, and joined the top bar, side posts and base plate as shown. The top bar was 3 in. long, 9/16 in. high and ½ in. wide, and was drilled and tapped for penetration by three 5/32 in. compression screws (m), a median one and one at ⅞ in. on each side. The press bar which moved between the side posts was 2⅛ in. long, ⅜ in. high and ⅜ in. wide. The ends of the press bar contoured the side posts, and its bottom side was convex with a 2 in. radius, an important

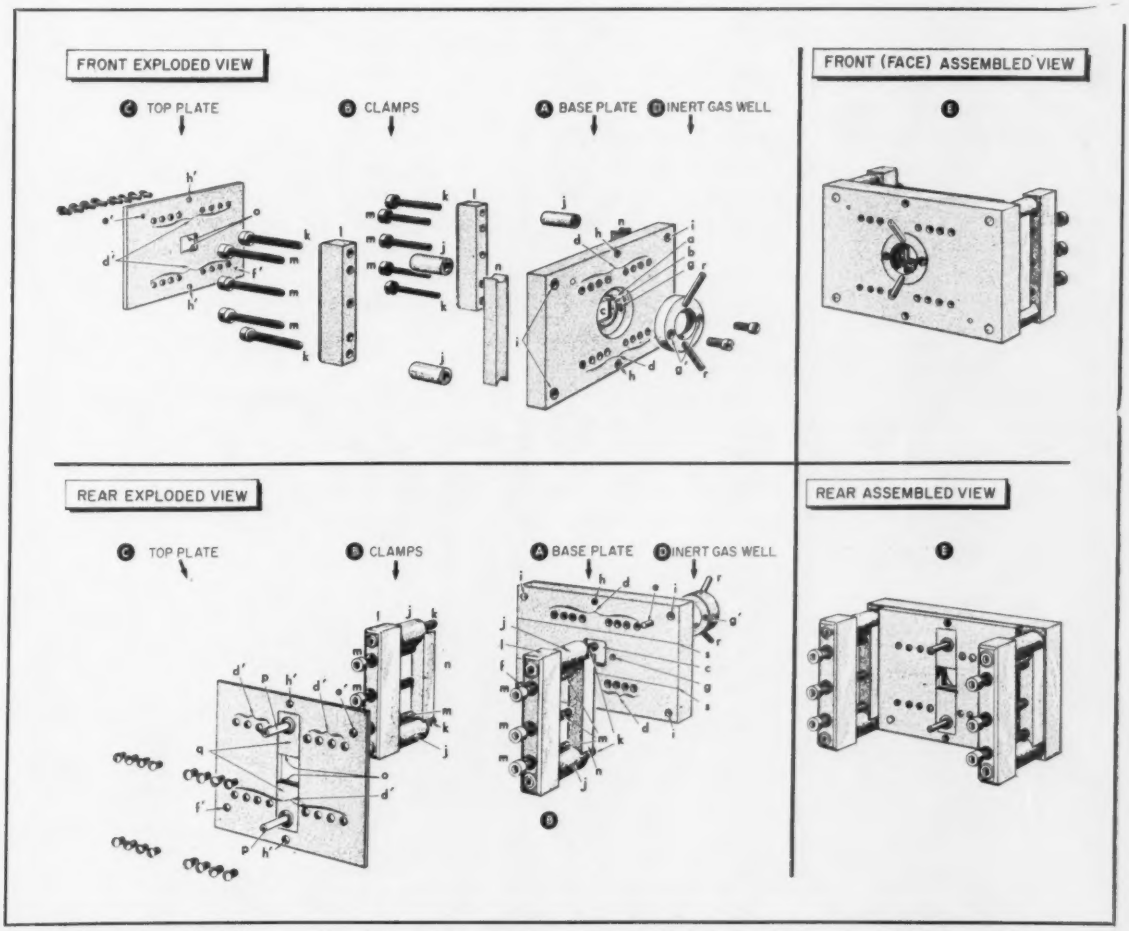


FIG. 2—Views of sample holder used for rubber specimens, with parts described in the text. Front and rear exploded views are shown on the left, front and rear assembled views of the apparatus on the right.

requirement for holding stretched specimens against the base plate without slippage or cutting.

The stainless steel top plate (C) was 3-11/16 in. long, 3⅛ in. wide and ⅛ in. thick. It was used to compress and immobilize a stretched and clamped specimen against the rear face of the base plate. Compression was effected by screws which penetrated the ⅛ in. holes (d′) in the top plate and the tapped holes (d) in the base plate. Holes (h′) matched holes (h) in the base plate. The top plate was positioned by holes (e′ and f′) which matched dowel pins (e and f) in the base plate. Two cavities (o) existed within the top plate, one on each opposite side of the aperture as illustrated. When nitrogen was fed liberally to the cavities via the tubes (p) during X-ray diffraction analysis, the rubber in the aperture was bathed on that side which contacted the top plate.

Nitrogen Feed System

Each cavity was made as follows: A trench—1 cm wide, 1 in. long and 1/16 in. deep—was milled in the top plate starting at the aperture. Next a narrower trench—8-mm wide, 1-in. long and 1/32-in. deep—was milled in the center of the first, which process produced a single trench with shoulders. A steel inlay (q)—1 in. long, 1-cm wide and 1/16 in. thick—having a hole around which the tube (p) had been soldered, was placed on the shoulders and soldered to form the roof of the cavity.

The inert gas well (D) consisted of a brass ring—47/64 in. I.D., 1-17/32 in. O.D. and 5/16 in. thick—with two 1/16 in. I.D. tubes (r) penetrating a face at 45 degrees to project 1/128 in. past the well's interior surface, as illustrated in Figure 2. The inert gas well fitted circular well (a) in the base plate and was secured therein by screws through the holes (g′) and in the tapped holes (g) in the base plate. The screws could not extend so far into the base plate that they touched the rubber specimen. When nitrogen was applied liberally to the tubes, the rubber in the aperture was bathed on that side which contacted the base plate. The inert gas well was used during X-ray diffraction analysis, but was removed for Cobalt-60 irradiations.

Procedure for Mounting Samples

A rubber specimen was mounted on the sample holder by an invariant procedure: The sample holder with its top plate and inert gas well removed was held face down in a vise. A 1⅞ x ¾ in. piece of latex dental dam about 10 mils thick was placed on the base plate beneath each clamp so that a 1⅞ in. side coincided with the edge of the base plate. These rubbers were held tautly with Scotch Brand tape, a short narrow strip of tape over each corner nearest the aperture and a 1⅞ in. long, narrow strip along the side at the edge of the base plate. The press bars of the clamps, except their top horizontal surface and upper side surfaces, were also covered with rubber dental dam held tautly by narrow strips of Scotch Brand tape along the sides of the bars.

The rubber specimen for mounting was a long strip of 1⅜ in. width, cut with a scalpel and metal template. The strip was extended through both clamps, positioned precisely by the scribed lines on the base plate (Figure 2), and firmly secured by one clamp. Care was taken not to tighten the screw clamps to the extent of damaging the specimen. A narrow ink dot was placed on the imaginary lengthwise median of the specimen strip near the tightened clamp at a point ⅝ in. from the end edge of the base plate. A second dot was placed on this median toward the aperture and 5/16 in. from the first dot. The ink dots were rewetted and the specimen was stretched through the loose clamp by winding around a rotating screwdriver.

During this operation the press bar of the loose clamp was held conveniently near its top position by a piece of Scotch Brand tape. The wet dots extended to lines which were kept precisely midway between and parallel to the scribed lines on the base plate as determined with a ruler. This fulfilled the important requirement that the direction of stretch parallel the lengthwise edges of the sample holder, so that orienting the sample holder on the X-ray diffraction unit by means of the edges served to orient the direction of specimen stretch. When stretching approximated a factor of 4, a new ink dot was placed along the midpoint of each extended line, and the exact degree of stretching was measured between the new dots. The clamp was tightened when stretching was exactly a factor of 4. If an extended line and dot became located over the aperture, they were removed carefully with a moist, lintless tissue. The superfluous specimen ends were cut off near the clamps and the top plate attached; the clamps were not touched unnecessarily thereafter. Stretching reduced the thickness of the specimens by approximately one-half of original size.

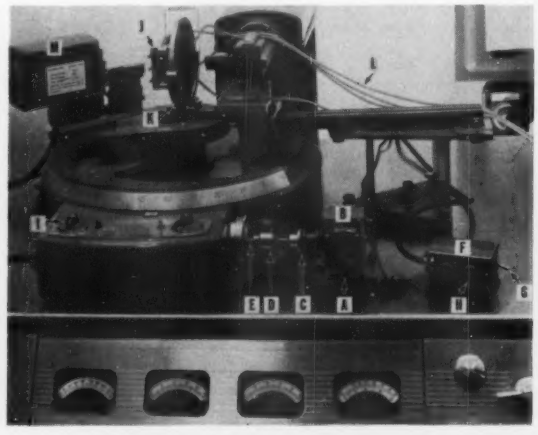


FIG. 3—Photo of X-ray diffraction unit shows the modification for controlling goniometer speed and the sample holder mounted for forward reflection measurement: (A) motor, (B) gear reduction box, (C) flexible coupling, (D) Jacobs Chuck, (E) shaft, (F) remote control, (G) motor switch, (H) X-ray button, (I) usual speed control (not used), (J) horizontally positioned sample holder, (K) sample holder positioner, (L) nitrogen tubes connected to sample holder, (M) Geiger Counter.

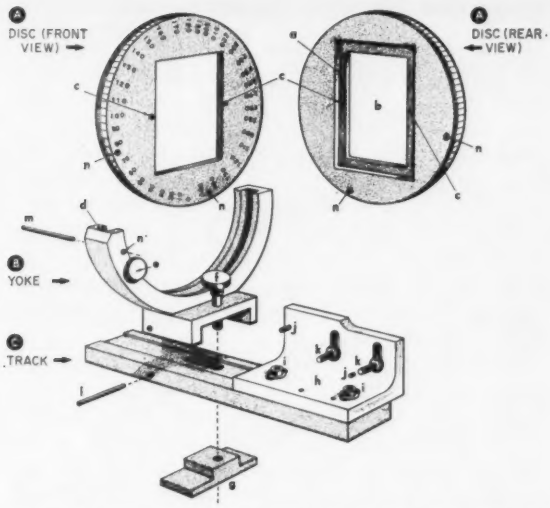


FIG. 4—Schematic diagram of sample holder positioner illustrates its construction and identifies parts described in the text.

Irradiating Rubber with Cobalt Source

The rubber samples were irradiated in a nitrogen atmosphere with a kilocurie Cobalt-60 source. Quadruple samples of each rubber were investigated and irradiated simultaneously. The sample holders were symmetrically positioned about the cylindrical source, and ferrous sulfate dosimetry showed an absorbed dose rate of 1.3×10^5 r/hr at the aperture positions. Irradiations and X-ray diffraction measurement were made at 75° to 80° F.

A nitrogen atmosphere was provided by sealing the rubber specimens in nitrogen-filled plastic bags. The sample holder was placed on a table so that it was supported by its clamps with its face up. The inert gas well was removed, a dime was set in the circular well [(b) in Figure 2] to protect against possible specimen injury, the tapped holes [(g) in Figure 2] were plugged with short screws, and the dime was removed. The screws could not be long enough to touch the rubber specimen, and were always in place during irradiation.

The sample holder was then placed in a 6 x 11 in., 10 mils thick polyethylene bag. Most of the mouth of the bag was sealed with Scotch Brand tape, the bag was flushed with 15 cu. ft. of nitrogen, and, finally, the mouth was completely sealed with tape. This combination was sealed within a second bag which was filled similarly with nitrogen. All seams on the plastic bags were taped for double sureness against leaks. All corners on the sample holders were rounded so they would not puncture the bags.

The irradiation schedule consisted of intermittent irradiation, with X-ray diffraction measurement between the increments, continued until the specimen either relaxed and lost its diffraction spots (crystallinity) completely, or ruptured. The specimens were removed from the source only long enough for measurement. The incremental irradiations were of approximately 4 or 8 hours' duration, and quadruple specimen measurement required about 3 hours. Total crystallinity loss was simply revealed when the X-ray spectrometer chart patterns for a horizontally and vertically positioned specimen became identical, as explained subsequently. Total loss of specimen crystallinity usually preceded rupture by such a short time that it was usually not observed. Partial loss was always seen.

Occasionally the specimen rendered totally noncrystalline remained intact in the aperture for a while before rupture, but such a specimen was considered a failure from the time its total crystallinity loss was first observed, because of its invariably cracked and damaged appearance. The exact time of specimen rupture or total crystallinity loss within the opaque irradiation chamber could not be determined, but this was of little consequence to the investigation. This time was estimated with sufficient accuracy as the midpoint of the irradiation increment immediately preceding the discovery of these events.

Patterns of diffraction intensity versus angle 2θ were obtained with the X-ray diffraction unit (General Electric Co. XRD-3) modified as shown in Figure 3 *(10)*. The following technique was used: Central, maximum intensity X-ray port; nickel-filtered (0.35 mil) copper radiation at 40 kvp and 20 ma (General Electric Co. X-ray tube CA-7); a 3-degree beam slit (Cat. No. A4954J); SPG Soller slit; a 0.05-degree detector slit (Cat. No. A4954U); a 5-degree target to beam angle; time constant B (6 sec.); Speedomax recorder range 1; nitrogen flow past the sample; and a goniometer speed of 1°/min. obtained by modifying the unit.

Modifications for Measurement

The modification is shown in Figure 3 and consists of: a Bodine motor (A) at 10 r.p.m. and 65 in.-oz. torque; a 10:1, specially fabricated gear reduction assembly (B); a Thomas flexible coupling (C) of style CA (No. 37, Brooks Equipment Co., San Francisco, Calif.); a ¼ in., light-duty Jacobs chuck (D); a shaft (E) attached to the vernier of the goniometer driving mechanism and engaging the Jacobs chuck; and remote control (F) for starting-stopping the motor by switch (G) and the X-rays by buttons (H). The motor could only rotate the goniometer to decrease angle 2θ and was fused to stop if the usual speed control (I) was not set in the **manual** position. The Jacobs chuck was disengaged in order to move the goniometer manually either with or without vernier control.

The rubber specimens were positioned, so that the direction of stretch was horizontal or vertical, by means of a positioner. The sample holder positioner consisted of three main parts as shown in Figure 4: a disc (A); a grooved yoke (B); and a track (C). The stainless steel disc was of 6¼ in. diameter and ⅜ in. thickness. Degree marks were scribed on the edge and numbered from 0 to 360 on one face which thereby became the front of the disc. A rectangular

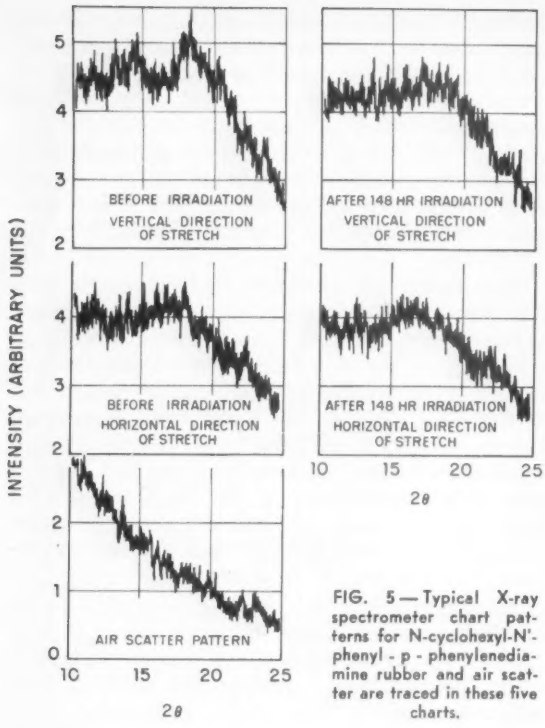


FIG. 5 — Typical X-ray spectrometer chart patterns for N-cyclohexyl-N'-phenyl - p - phenylenediamine rubber and air scatter are traced in these five charts.

well (a) was milled in the center of the rear face and was 4-47/64 in. long, 3-9/64 in. wide and ⅛ in. deep. The 0 and 180 degree scribe marks lay on the disc diameter which was parallel to the long edges of the well. A 4⅛ in. by 2⅝ in. rectangular hole (b) was centered within the well. The well received the front face of the sample holder (Figure 2), and the sample holder and disc were secured by screws which first penetrated holes (h) in the sample holder, and then the tapped holes (c) in the disc of the positioning attachment.

The grooved yoke (B) received the disc and allowed it to rotate with a firm fit. The extent of rotation was given by the degree mark on the disc's edge opposite the knife-edge (d). The screw (e) contacted the front face of the disc and secured it at any position. The yoke was joined to the track (C) by means of screw (f) and bar (g) which had a tapped hole to receive the screw.

The track (C) was 9 in. long, 1½ in. wide and 13/32 in. thick. The angle bracket (h) was an associated part, permanently joined to the track by dowel pins and Allen head screws (i). The track was attached to the XRD-3 beam slit bracket so that it pointed toward the Geiger counter, and was reproducibly secured by dowel pins (j) and Allen head screws (k). When assembled and attached to the beam slit bracket, the track and bar (g) were suspended 3/16 in. and 1/32 in., respectively, above the rotating support for standard XRD-3 sample holders, as shown previously in the detailed exploded views of Figure 2.

Precise Vertical Stretching of Specimen

In the assembled apparatus the disc fit in the yoke with its front face toward the XRD-3 beam slit, which caused the rear (clamp side) of the attached sample holder to face toward the Geiger counter. Figure 3 shows the sample holder positioner, containing the holder, in position on the XRD-3 X-ray diffraction unit. The sample holder aperture was positioned precisely over the goniometer pivot point and lined up exactly with the XRD-3 beam and Soller slits. The dowel pin (l) accomplished pivot point positioning conveniently, and the dimensions of the yoke assured aperture-slit alignment.

Furthermore, the dowel pin (m) which matched holes (n) could position the disc in the yoke so that the long edges of the well (a) were either exactly vertical or horizontal. This was tantamount to an exactly vertical or horizontal placement of the attached sample holder and, thus, similar directions of stretch for the rubber specimen. Precisely vertical specimen stretching was important for reproducible, horizontal Geiger scanning through the diffraction spots of measurement interest which always formed on an axis perpendicular to the direction of stretch. The sample holder was always attached to the disc with the same end always facing the 0 degree mark on the disc in order to attain constant sample placement.

As illustrated by the X-ray diagram of Figure 1, specimen positioning with the direction of stretch horizontal caused the Geiger counter to scan the rubber amorphous halo and such other concentric diffraction rings which might appear with various vulcanizates. In addition, vertical positioning presented some crystallinity diffraction spots. All specimens were scanned between 2 θ angles of 9 and 25 degrees. This region extends just beyond the rubber amorphous halo and its associated diffraction spots.

Obtaining Diffraction Patterns

A diffraction pattern for the rubber amorphous halo was obtained by subtracting the spectrometer chart pattern for air scatter from the chart pattern for a specimen stretched in the horizontal direction. The chart pattern for air scatter was corrected for a calculated 9 per cent absorption of the X-ray beam by the rubber sample before the subtraction. Typical spectrometer chart patterns are shown in Figure 5.

A diffraction spot pattern was obtained by subtracting a spectrometer chart pattern for a specimen stretched in the horizontal direction from the corresponding one for a vertical direction of stretch. The subtraction removed the influence of the amorphous halo as well as the influence of air scatter since this was a constant factor. It has been shown previously that the diffraction spot pattern obtained by the subtraction may be considered to be a semi-quantitative diffraction view of the specimen, useful for following and comparing radiation damage in rubber *(1)*.

Counting performance was checked frequently during each series of measurements by scanning a non-

stressed, standard rubber sample. The standard sample assembly consisted of a base plate, a piece of rubber and a top plate. The base plate was similar to that of the sample holder (Figure 2), except that holes for attaching stretching clamps were deleted, and that a groove (1 in. wide and 10 mils deep) was milled in the center of the rear face to make it parallel to the short edges of the plate and intersecting the aperture. A 10-mil thick, 1-in. wide strip of the standard rubber was placed in the groove across the aperture and the ends (Scotch Brand) taped to the base plate. The top plate, similar to that for the sample holder except that inert gas cavities were deleted, was then doweled and screwed to the rear face of the base plate. The standard rubber sample assembly was attached to the disc (A) of the sample holder positioner (Figure 4), similarly to the procedure for the sample holder.

Air scatter patterns were determined with a mock-up replacing the sample holder in the disc of the sample holder positioner. The mock-up was similar to the aforementioned standard rubber sample assembly, except that the aperture was left vacant.

What Causes Radiation Damage

Stretched rubber is extremely sensitive to radiation damage. It is believed that chain scission, manifested by loss of crystallinity and diminution of diffraction spot intensity, dictates the physical-mechanical radiation behavior of stretched rubber. Stress relaxation would make scissions irreversible and their increase would soon weaken the specimen to the point when the chains slip and rupture of the specimen occurs. Cross-linking undoubtedly occurs simultaneously, but at too slow a rate to prevent destruction of the specimen. The extremely low doses which cause rupture in stretched specimens do not produce detectable physical-mechanical changes in unstretched rubber where cross-linking predominates.

Loss of diffraction spot intensity (or crystallinity) due to irradiation is shown in Figure 6 for the standard and N-cyclohexyl-N'-phenyl-p-phenylenediamine rubbers. The curves represent the decrease in peak intensity of that diffraction spot (2θ, 19°) which lies on the upper Y axis and on the outer shoulder of the amorphous halo in Figure 1. This was the diffraction spot measured for all rubbers. The curves were constructed from numerous diffraction spot patterns corresponding to various irradiation times. For example, the fractional decrease in spot intensity of 0.63, shown in Figure 6 for the N-cyclohexyl-N'-phenyl-p-phenylenediamine rubber (specimen 3) at an irradiation time of 148 hours, was calculated from the diffraction spot patterns in Figure 7. These, in turn, were derived from X-ray spectrometer chart patterns shown in Figure 5. The other rubbers provided curves similar to the N-cyclohexyl-N'-phenyl-p-phenylenediamine rubber, except that they varied in proximity to the standard rubber curve.

The radiation resistances of the rubbers were compared on the basis of their crystalline longevities relative to that of standard rubber. The relative crystalline longevity of a rubber was determined from its curve of diffraction spot intensity versus irradiation time (Figure 6). It is defined as the ratio of the area under that curve to the area under the similar curve for the standard rubber. A greater longevity connotes a

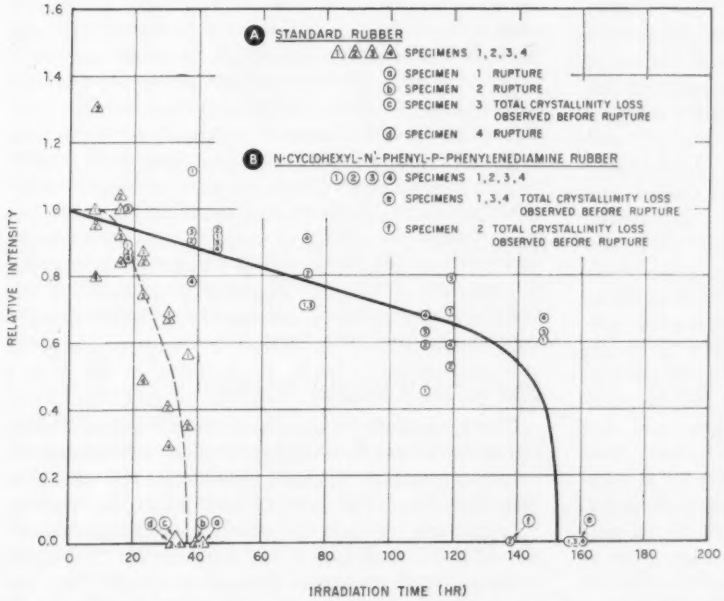

A STANDARD RUBBER
SPECIMENS 1, 2, 3, 4
ⓐ SPECIMEN 1 RUPTURE
ⓑ SPECIMEN 2 RUPTURE
ⓒ SPECIMEN 3 TOTAL CRYSTALLINITY LOSS OBSERVED BEFORE RUPTURE
ⓓ SPECIMEN 4 RUPTURE
B N-CYCLOHEXYL-N'-PHENYL-P-PHENYLENEDIAMINE RUBBER
①②③④ SPECIMENS 1, 2, 3, 4
⑤ SPECIMENS 1, 3, 4 TOTAL CRYSTALLINITY LOSS OBSERVED BEFORE RUPTURE
⑦ SPECIMEN 2 TOTAL CRYSTALLINITY LOSS OBSERVED BEFORE RUPTURE
RELATIVE INTENSITY
IRRADIATION TIME (HR)

FIG. 6—Decrease in diffraction spot intensity (peak value at $2\theta = 19°$) versus irradiation time of N-cyclohexyl-N'-phenyl-p-phenylenediamine and standard rubber.

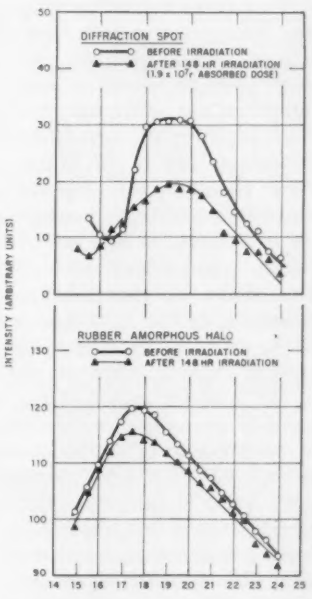


FIG. 7—Typical X-ray diffraction patterns for Type B rubber of Fig. 6.

TABLE II—RELATIVE CRYSTALLINE LONGEVITY, TENSILE STRENGTH AND ULTIMATE ELONGATION FOR RUBBERS

Rubber	Relative Crystalline Longevity	Tensile Strength (psi)	Ultimate Elongation (%)
N-cyclohexyl-N'-phenyl-p-phenylenediamine rubber	4.00	2900	600
Indocarbon CL rubber	1.60	2000	500
Carbanthrene Khaki 2G rubber	1.20	2800	600
Standard rubber	1.00	2100	600
Immedial New Blue rubber	0.89	2050	550
Graphite rubber	0.74	1850	500
Phthalocyanine rubber	0.69	2400	650
Didodecyl selenide rubber	0.55	2400	650
Copper phthalocyanine rubber	0.45	2600	600

greater resistance. Relative crystalline longevities are given in Table II for all rubbers investigated.

The radiation resistance of stretched rubber depends greatly upon composition. Table II shows that the addition of a few per cent of an additive to the standard rubber can markedly increase or decrease relative crystalline longevity. The relative crystalline longevity of the most and least radiation-resistant rubber differed by a factor of 9. It has been assumed that the additives used in this study were not destroyed by vulcanization; probable survival was one of the criteria used in their selection.

Additives Enhance Resistance

The stretched N-cyclohexyl-N'-phenyl-p-phenylenediamine rubber exhibited the best radiation resistance with a relative crystalline longevity of 4. Two studies with **un**stretched rubber have also shown the usefulness of resonantly stable N-cyclohexyl-N'-phenyl-p-phenylenediamine as an anti-radiation additive for natural rubber. Born has reported *(4)* that it substantially improves the retention of tensile strength and elongation, and R. E. Morris (Rubber Laboratory, Mare Island Naval Shipyard, Vallejo, Calif.) has found that it decreases compression set significantly. Chain cleavage is believed to predominate in irradiated stretched rubber and cross-linking in unstretched. The ability of N-cyclohexyl-N'-phenyl-p-phenylenediamine to protect both stretched and unstretched rubber supports the hypothesis that an additive which can mitigate chain cleavage can also mitigate cross-linking.

The superior radiation resistance of the N-cyclohexyl-N'-phenyl-p-phenylenediamine rubber was due to the presence of the protective additive rather than to superior initial tensile strength or ultimate elongation. Table II compares relative crystalline longevity, tensile strength and ultimate elongation of all the rubbers, and shows no correlation between these properties. The tensile strengths and elongations are viewed as essentially constant factors for all rubbers tested.

Both oxidative and non-oxidative radiation damage may occur in elastomers, hence the ideal anti-radiation additive would protect against both. Oxidative damage arises from radiation-produced ozone. The damage observed in this study was non-oxidative, since the specimens were mill-mixed vulcanizates incorporating essentially no free oxygen, and they were irradiated in an oxygen-free atmosphere. The specimens had no visible air bubbles. It is believed that they contained no free oxygen, only nitrogen, in any possible microbubbles, because the energized molecules and free radicals formed during milling are quite reactive toward oxygen and are expected to remove it, one type of intermediate product being a hydroperoxide at an activated allylic position *(11)*. The possibility exists that combined oxygen may rearrange, possibly detrimentally, with mill-mixed rubber on irradiation. The rubber additive, N-cyclohexyl-N'-phenyl-p-phenylenediamine, may be expected to protect against both oxidative and non-oxidative radiation damage, since it is a rubber antioxidant, and it afforded protection against non-oxidative damage, predominantly chain cleavage in this study.

Indocarbon CL gave some degree of protection against radiation with a relative crystalline longevity of 1.6, whereas Immedial New Blue did not, with a relative crystalline longevity of 0.89. These sulfur dyes possibly combined with the substrate via sulfur bonds, and their sulfur may also have been responsible for a somewhat increased cure. If the Indocarbon CL were chemically combined with the rubber, intramolecular transfer and degradation of absorbed radiation energy may have been a protective mechanism.

A rubber additive exhibiting resonance and large molecular size does not necessarily afford effective anti-radiation protection. Carbanthrene Khaki 2G, phthalocyanine and copper phthalocyanine illustrate this in that their rubbers gave relative crystalline longevities of only 1.2, 0.69 and 0.45, respectively. Nevertheless it is held that, given the proper chemical structure, a large resonant chemical will protect against radiation by receiving energy intermolecularly from the substrate, distributing it generally over its own large molecular volume, and dissipating it at various sites in amounts insufficient to cause undesirable substrate reactions. Perhaps this hypothetical, large additive should be relatively long, narrow and flat, so that it would not interfere with and strain the ordered arrangement of stretched chains in the crystalline domain, a phenomenon which would enhance recoil and crystallinity loss after chain scission.

Other Factors in Maximum Protection

The presence of a chemically stable and radiation-stable ingredient in a vulcanizate does not necessarily confer protection against radiation. The graphite, phthalocyanine and copper phthalocyanine rubbers illustrate this by their low relative crystalline longevities of 0.74, 0.69 and 0.45, respectively. Bopp and Sisman's work confirms this observation. They reported *(12 and 13)* that the physical properties of an irradiated, unstretched elastomer having a radiation stable filler changed at approximately the same rate

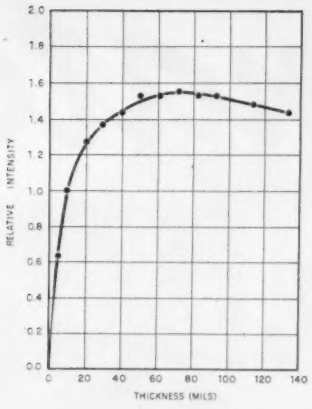


FIG. 8—Curve for halo diffraction intensity versus rubber specimen thickness demonstrates test technique's sensitivity to halo intensity.

as the unfilled polymer. Their results with plastics are contradistinctively interesting showing that the addition of radiation resistant fillers (including graphite) to Bakelites improved the retention of tensile strength upon irradiation, while fillers of poor stability had the opposite effect. The poor performance of copper phthalocyanine could not be due to the presence of ionic copper which causes rapid and far-reaching deterioration in rubber. The copper is too tightly bound within this pigment to cause deterioration.

A proficient antiradiation additive for one substrate is not necessarily proficient for another, somewhat similar substrate. Didodecyl selenide, effective with lubricating oils *(5)*, was tested as an antiradiation additive in rubber on an empirical basis. It produced a rubber with a poor relative crystalline longevity of 0.55.

The decreases in diffraction spot intensity on irradiation, which were observed in this study, have been interpreted as due to a decrease in crystallinity without any appreciable sample thinning, at least until just before rupture. Both crystallinity decreases and sample thinning are capable of lowering spot intensity. As crystallinity is decreased, a shift of X-rays from spot to halo diffraction occurs; but the resulting reinforcement in halo intensity is small, since the spot rays, which are of low intrinsic intensity and low areal distribution, become integrated uniformly throughout the large areal distribution of the intense halo rays. The X-ray diffraction technique described herein is insensitive to this small reinforcement in halo intensity. However, as shown in Figure 8, it is extremely sensitive to the relatively large changes in halo intensity which are effected by small thickness changes in very thin rubber specimens. Thus, a decrease in halo intensity signifies a decrease in thickness, whether or not there are crystallinity changes.

Figure 7 shows pre-irradiation spot and halo diffraction patterns, as well as patterns taken after a damaging dose—one sufficient to cause a decrease in spot intensity — for the N-cyclohexyl-N'-phenyl-p-phenylenediamine rubber. These patterns typify over one hundred others which were observed with the various rubbers and damaging doses of this study. They show a significant decrease in the diffraction spot peak, but no large decrease in halo intensity.

Bovey has speculated as follows *(14)*: "It is conceivable that there may be classes of compounds which absorb ionizing radiation particularly readily and can pass it on to a surrounding polymer structure, this acting in the same manner as sensitizers for visible and near ultra-violet radiation. Substances which accelerate the action of ionizing radiation on polymers seem to be have received little or no attention. It appears that an important field for exploration is open here, one that may be of considerable practical as well as academic interest." Those rubber additives with a relative crystalline longevity of less than unity, which accelerated the predominant chain cleavage reaction in the stretched rubbers of the present study, are hypothesized as belonging to the class of radiation sensitizers mentioned by Bovey.

ACKNOWLEDGEMENT

The authors wish to express their appreciation to R. E. Morris for the preparation of rubber specimens and for the measurement of tensile strength.

NOTE

This paper was presented before the Division of Polymer Chemistry, ACS, at Atlantic City, New Jersey, September 17, 1959. The opinions or assertions are the private ones of the authors, and are not to be construed as offical or reflecting the views of the Navy Dept. or the Naval Service at large.

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Automation dominates new Russian Tire Plant

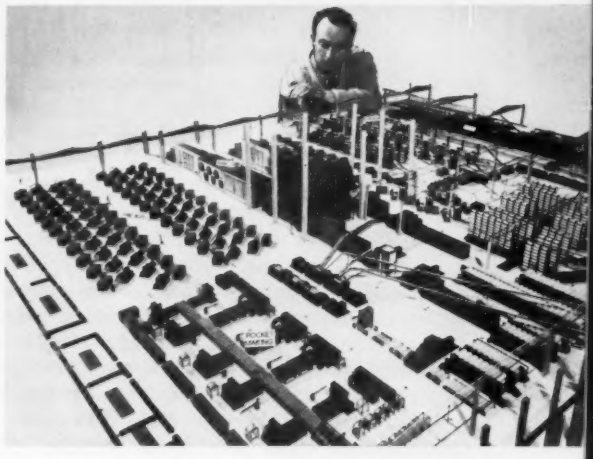

FIG. 1—A model shows the main building complex of the new Russian tire factory at Dnepropetrovsk, designed by the English firm, Dunlop Advisory Services Ltd.

TO BEGIN our survey of basic design features at the new Russian plant—electric power is brought to the site by overhead transmission lines at 154,000 volts and is transformed to 6,000 volts through two 31,500 KVA transformers. The 6,000 volts supply is fed to a 27-panel main switchboard for distribution via ring mains to 11 sub-stations.

In these sub-stations five 14-panel switchboards supply power by means of ring mains at 6,000 volts to the main motors driving the heavy mixing and processing machinery. For low voltage current, a total of eighteen 1,000 KVA transformers reduce the voltage from 6,000 volts to 380 volts.

All the sub-stations have been designed on a package basis in order to give a high degree of standardization and uniformity. The H.T. and L.T. electrical distribution system has interconnections to ensure continuity of service. Mimic diagrams are used wherever visual indication is desirable to observe remote conditions.

Steam and Water Supply

Steam is piped to the factory from an adjacent power station and the total consumption used will be on the order of 180,000 lb./hour. Process cooling water will be obtained from local storage originating from the Dnieper River. Limitation on the volume of water which may be drawn from the river necessitates the maximum possible use before returning water to waste.

There will be three cooling circuits fed under pressure from a central pumping station at approximately 2,000 gallons/minute. First circuit water will be a closed circuit delivery to machines requiring maximum cooling.

During the hot season, when temperatures in the region of 85° C. are common, first circuit water will be passed through a refrigeration plant having a capacity equal to 2,400 tons/hour of ice. Second circuit water, after a single pass, will be transferred to third circuit, and from there to waste. There will also be closed circuit high pressure hot water circulating systems for the close control of fabric calender roll temperatures and also for the tire vulcanizing presses.

Giant Building Complex

The manufacturing building is approximately 1,179 feet long and 570 feet wide with a 3-story section at the west end giving a total floor area of 765,000 sq. ft., or 17½ acres (Figure 1).

The mill room section, housing the automatic powder handling system, occupies ground, first and second floors, the remainder of the building being varied in height in relation to the demands of the various processes.

Situated alongside the east end of the manufacturing block is what might be termed an administrative office building having three floors and a basement, the first floor being connected by bridgeways to the manufacturing building. On the outside of the main manufacturing building are service buildings housing air compressors, water pumps, main electrical switch-

Behind the Iron Curtain . . .

. . . a new tire plant is being constructed which may prove to be one of the most modern in the world. The plant, which will cover an area of some 80 acres, is located at Dnepropetrovsk near the Dnieper River in the Ukraine. Automated equipment for the new facility is being manufactured by a consortium of British companies operating under the name of Rustyfa Ltd. Dunlop Advisory Services Ltd., Fort Dunlop, England, is serving as technical consultant, placing their wide experience in automation and tire manufacture at the disposal of the British consortium and its Russian customers. This report on the emergent industrial giant was written exclusively for RUBBER AGE.

gear, a tire test house, research laboratory and maintenance machine shop. All the buildings are of precast, reinforced concrete construction.

A separate building, having a total floor area of 326,000 sq. ft. alongside the main manufacturing building, is arranged to accommodate the necessary stocks of raw materials at one end and the finished goods at the other. Raw materials, i.e., powders and raw rubber, will be carried on post pallets. Adjacent to this building are concrete silos provided for the reception and storage of the various carbon blacks.

The stock-preparation department of the Dnepropetrovsk tire works has a total area of 6,480 square meters. One part of the building is single-storied and the other part consists of three floors; the height of the roof is 20.3 meters (Figure 2). Each part is 18 meters wide and 180 meters long. A single-storied building 12 meters wide is built on the side of the stock-preparation department for preliminary processing of the raw rubbers.

Automizing Stock Preparation and Weighing

On the ground floor are bale cutters for cutting the raw rubbers, 20-in. "Gordon" plasticators, rooms for drying the rubbers and masterbatches after pelletization, and the necessary conveyor belts. On the first and second floors there are hoppers for the immediate storage of the raw material, and all the automatic weighing equipment. In the single-story part of the building there is a gantry on which thirteen rubber mixers (four 40 r.p.m. and nine 30 r.p.m.) are arranged in a row. A direct flow of the main stocks is planned without intermediate storage which is only provided for stocks used in small amounts. After passing through a festoon cooler these stocks are put on racks and sent to the intermediate storehouse.

One special feature of the stock-preparation department of the Dnepropetrovsk tire works is that all rubber mixers are in series with the automatic weighing equipment and pelletizers or mills. In addition to rapid mixing, at increased pressure, maximum mechanization and automation of the handling equipment is envisaged. The weighing of the main components of rubber stocks is completely automatic, from small amounts of accelerator to large quantities of carbon black, pelletized rubbers and masterbatches. This makes it possible to use rapid mixing systems.

The program control of the automatic weighing is effected by means of punched cards and, together with the automatic control of the mixing process and a system of interlocked controls, this ensures that all operations are carried out in set sequence. A steady working process is thus established and standard rubber stocks of improved quality are obtained.

In accordance with accepted practice all processes for preparing rubber stocks at the Dnepropetrovsk works can be grouped under three main methods: (1) Two-stage manufacture of tread stocks on 40 and 30 r.p.m. mixers. Duration of first cycle is 2.5 minutes,

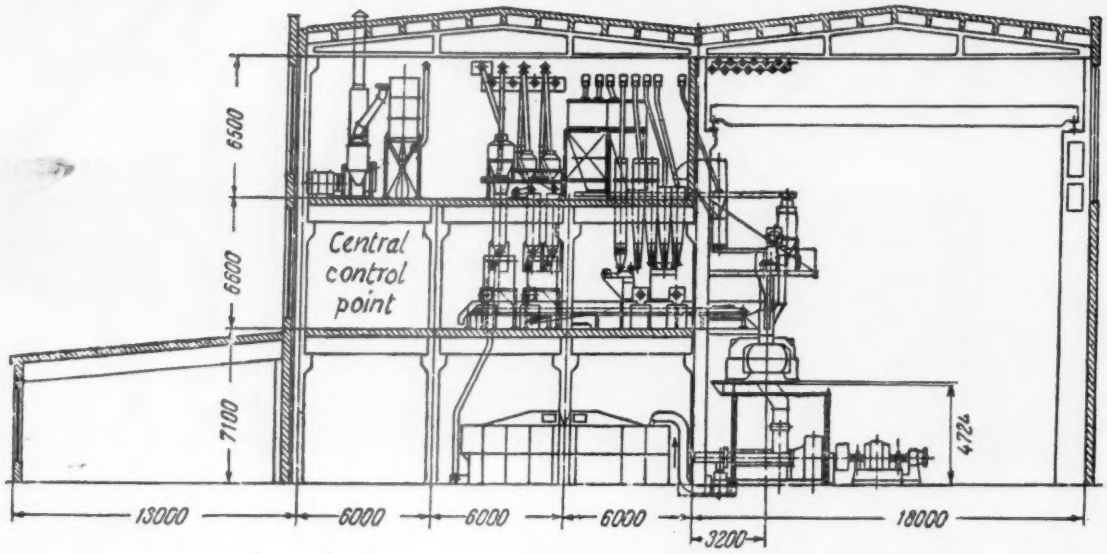

FIG. 2—The new plant's stock preparation department will utilize automatic weighing equipment in series with pelletizing and mixing equipment, as shown on this diagram. Dimensions are in centimeters.

of the second 2.5 minutes. (2) Two-stage manufacture of inner tube stocks on a single 30 r.p.m. mixer. Duration of first cycle is 4 minutes, of the second 2.5 minutes. (3) One-stage production of carcass, breaker strip squeegee layer and various other stocks on a 30 r.p.m. mixer. Duration of the mixing cycle is 6 to 9 minutes.

Inner-Tube Manufacturing Process

One special feature of the method of the manufacture of inner-tube stocks is that the two-stage mixing is effected on the one mixer which is coupled to a 15/18-inch pelletizer and three 84-in. mills. (Figure 3). The stock passes from the mixer to the pelletizer or mills by means of a reversible conveyor belt (17). Pelletized rubber from hoppers (12) is fed to automatic scales (13), then to an enclosed conveyor belt (14). Rubber which are not pelletized are weighed out manually on scales (23). Carbon black from hoppers (1), softeners from the circulating pipes and free-flowing chemicals from hoppers (8) are weighed on scales (2, 5, 6, 9 and 10). The carbon black then enters an intermediate container (3) while the softeners go to an air-tight container (7), and the free-flowing chemicals pass on to the conveyor belt (14).

All the materials are automatically charged from the intermediate containers to the rubber mixer (15) for the first stage of the mixing. The inner-tube masterbatch is then fed to a strainer-pelletizer (16) by means of the reversible conveyor belt (17). Here it is strained and pelletized at the same time. The pellets enter the cooling and drying system and are then passed to receptacle (21).

The pellets are transferred via a pressure line (22) into a hopper (28) and then weighed on automatic scales (29). The inner-tube masterbatch pellets are

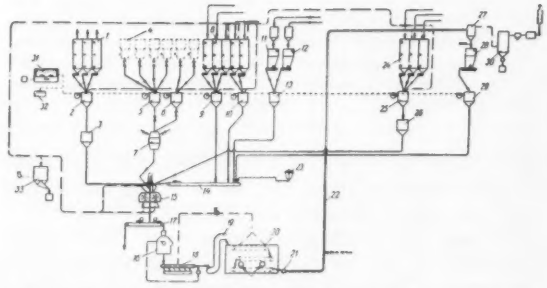

FIG. 3—This block diagram traces the process for manufacturing inner-tube stocks at the Dnepropetrovsk plant.

then loaded on to the same enclosed conveyor belt (14), which charges them into rubber-mixer (15) for the second stage of mixing.

The sulfur and accelerators are weighed on scales (25) and collected in a container (26) from which, for 20-30 seconds before the end of the cycle, they are dropped into the rubber-mixer. The stock is then thoroughly worked on the mills. The first and second mixing cycles are controlled by a general control panel (31). The dust which forms in the process is collected in a container (33).

Masticating and Pelletizing Rubber

The preparation and supply of ingredients to the hoppers and containers is for three groups of materials: rubbers, free-flowing materials and softeners.

Provision is made for the pelletization of natural and butadiene-styrene rubber so that it can be weighed automatically. After thawing by high-frequency currents in a special chamber, natural rubber is cut up on a Star bale cutter. It is then fed to a 20-in. "Gor-

don" plasticator, fitted with a pelletizing head. Here the natural rubber is masticated and pelletized at the same time.

In the layout of the pelletization section (Figure 4) pelletization of the majority of the natural rubber is carried out by a machine (4). Partial pelletization of the natural rubber is also possible on machines (3) after mastication in the rubber-mixer (11). The natural rubber pellets are then transferred to hoppers (II, V, VII, VIII, X, and XIII) where they are stored.

Butadiene-styrene rubbers are pelletized on machines (1 and 2) and partly on another machine (3). The pellets are stored in hoppers (I, II, IV, IX, XI and XII). A 15/18-in. strainer-slabber-pelletizer is specified in the machine (3) which, by using an interchangeable head, can function both as a pelletizer and as a strainer-slabber. This unit is used as a strainer-slabber in processing low-grade rubbers that are freed from mechanical impurities and supplied to the mixer in the form of lumps weighed by hand.

Each of the pelletizing units (1, 2, 3 and 4) is equipped with individual vacuum equipment. The pellets are also removed from the intermediate hoppers (5) to the distributor-hoppers (10) by means of separate vacuum devices (9). The distributor-hoppers are automatically filled with pellets by the impulse of a level indicator fitted in each hopper. The use of separate vacuum equipment for each of the pneumatic lines used for transporting the pelletized rubber is obviously preferable to a common pressure pump because it makes the system more flexible. Should one piece of mechanism go out of action, this does not prevent the others from functioning. In addition, it is more hygienic, as no dust is caused when vacuum equipment is used.

One special feature of the system is the use of multi-section hoppers with pull-out trays (5) for storing the pellets. A hopper works as follows: From a cyclone (7) the pellets drop into the top section of a hopper (Figure 5). When the section is full, the level indicator releases the bottom and the pellets pour into the lower section. There is a continuous movement of pellets from one section to others; this precludes the possibility of their sticking together.

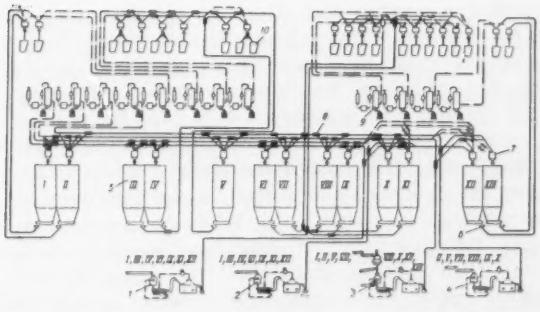

FIG. 4—The layout of the pelletization section, indicated on this block diagram and described in the text, provides for pelletizing, transport and storage of natural and butadiene-styrene rubbers, as well as special processing of low grade stock.

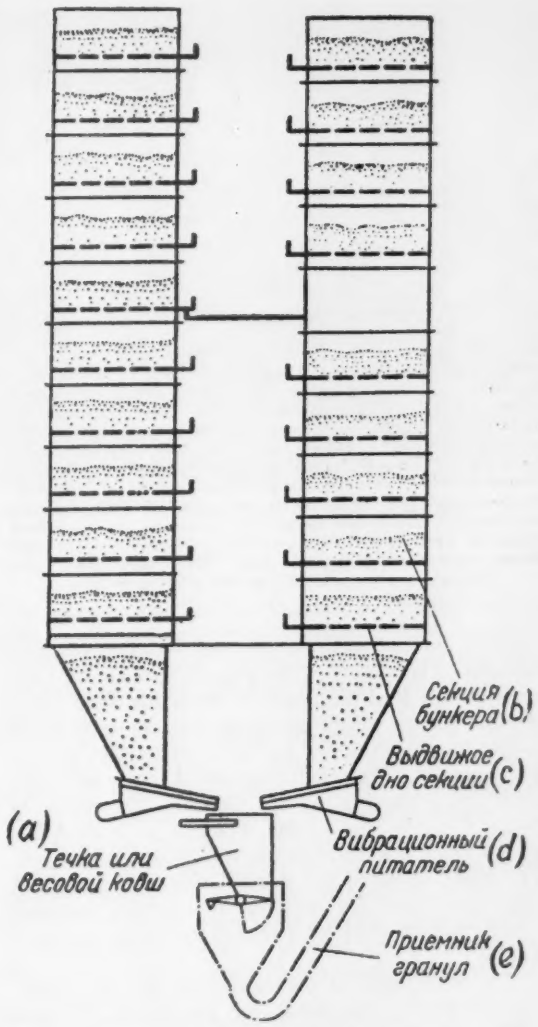

FIG. 5—The Russian text on this diagram of a section hopper for storing pellets of rubbers and masterbatches refers to: (a) flow or scale pan, (b) section of hopper, (c) pull-out trays, (d) vibrating feed, and (e) receptacle for pellets.

When there is no stock of pellets in the lower section the level indicator operates, and a system of changeover valves (8) is switched in so that the pellets from the appropriate machine begin to enter the top section of this hopper via the air system. As the hoppers consist of separate sections arranged one on top of another, the total volume of a hopper can be varied by altering the number of sections.

Punched Cards Control the Scales

The process of weighing is to be fully automated at the Dnepropetrovsk tire works by having 77 automatic scales installed, serving more than 200 hoppers and containers.

The complexity of the process of automating weighing in the rubber industry lies in the wide variety of materials that have to be weighed, the considerable

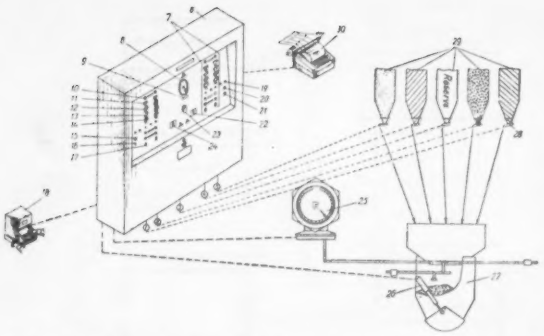

FIG. 6—Diagram showing the automatic weighing of free-flowing chemicals and program control operated by punched cards: (1-5) impulse lines controlling feeders, (6) central control, (7) ingredients (hoppers), (8) remote current indicator, (9) weight recorder, (10) signal "insufficient material in hopper," (11-13) setting given weight (hundreds, tens and units), (14) compensating scale, (15) signal "adjust tare," (16) "start" button, (17) selector switch, (18) deciphering device, (19) signal "sequence of operations," (20) signal "scale pan open," (21) signal "scale pan closed," (22) system switch, (23) computer for calculating amount of material, (24) function switch, (25) scale dial, (26) pan closing mechanism, (27) scale pan, (28) hopper feed, (29) hoppers for chemicals, (30) electric printing machine.

range of amounts and the frequent variation of these amounts. The variety of the ingredients calls for various types of feed mechanisms, while the wide range of amounts and their frequent change demands scales of various ranges and a system whereby they can be easily altered. The remote control of scales and automatic programming of the batches by means of punched cards—the system which is to be installed at the Dnepropetrovsk works—is of special interest. The basic layout of the system, with a single pair of automatic scales for weighing free-flowing materials which is controlled by punched cards, is shown in Figure 6.

The main units of the equipment are as follows: control panel; equipment for calculating formulae from a punched card (deciphering devices); hoppers with controllable feeds for the materials; dials of scales; scale pan; and an electric printing machine.

On the control panel there is: (1) A signal indicating when there is no material in the hopper; (2) A remote control unit with three scales—hundreds, tens and units—this being used to regulate the system so that the required amount of material is obtained when opertaing without punched cards; (3) A compensating scale for calculating the weight of a column of material entering the scale pan when the hopper feeder has stopped working; (4) A selector switch to bring the hopper in to operation, or to switch it out of the system if material in the hopper is not to enter the composition of the stock; (5) A switch to switch in the system to operate weighing by means of punched cards or for remote control from the control desk; (6) A device for recording weight; (7) A function switch for the depth measuring gauge, and automatically switching the system off after the given amount of material has been obtained.

In addition, there are on the panel starting devices, as well as special lights indicating the sequence of operations and the open and closed positions of the scale pan.

Ingredients Mixed by Computer

The device works as follows: When the system has been set in operation, the weighed material is supplied by automatically controlled feeders from hoppers to the scale pan in the set sequence. The scale pan is automatically unloaded on completion of the cycle of weighing out the amounts or on receiving the appropriate electrical signal, which is interconnected with the subsequent operation in the manufacturing process. During the weighing process, the pointer moves round the scale.

The control system is so designed that the amount of material in the scale pan, which determines the position of the pointer, is continuously compared with the predetermined weight for the batch. When these two values are the same, the feeder stops working and that of the next hopper cuts in. This comparison is made by electronic equipment which receives a continuous impulse from a variable resistance located on the spindle of the scale pointer.

As has been previously shown, the system is set and controlled by punched cards. The punched card is a stiff paper form of standard size with 65 vertical columns containing the numbers 0 to 9. Depending on the mix, different holes are punched in this form for programming the weighing process and controlling it. Each mix has a different punched card. For example, if four types of materials are to be weighed in amounts of 0.75, 150, 225 and 300 grams respectively for one working cycle, holes are punched in the form with a special device; for material No. 1, 0-7-5, for material No. 2, 1-5-0, for material No. 3, 2-2-5, and for material No. 4, 3-0-0.

The card is then placed in the computer (deciphering machine) where contact is made through the punched holes of certain elements of the system for controlling the weighing process. Holes can also be punched in the card to control a group of scales; there is a single automatic control device for all the scales required for each rubber-mixer and thirteen such devices in all are planned for the Dnepropetrovsk works.

Ensuring Efficiency and Safety

In addition to automatic control, all the necessary interlocked controls and safety devices are provided in the schemes. The weighing cycle will not begin unless the scales have been accurately tared. Insufficient material in the hopper automatically halts weighing, but when the supply is renewed the process is resumed from where it was interrupted. Should the power supply fail, one of the electric drives break down or anything be disturbed in the operation of the process—the system stops. When the fault is eliminated, the cycle carries on from the point it reached. Interlocked controls ensure that the scales are unloaded only if the intermediate container is suitably prepared, and when the subsequent operation is ready.

Interchangeable units and parts are used extensively in this particular device. The main blocks of the

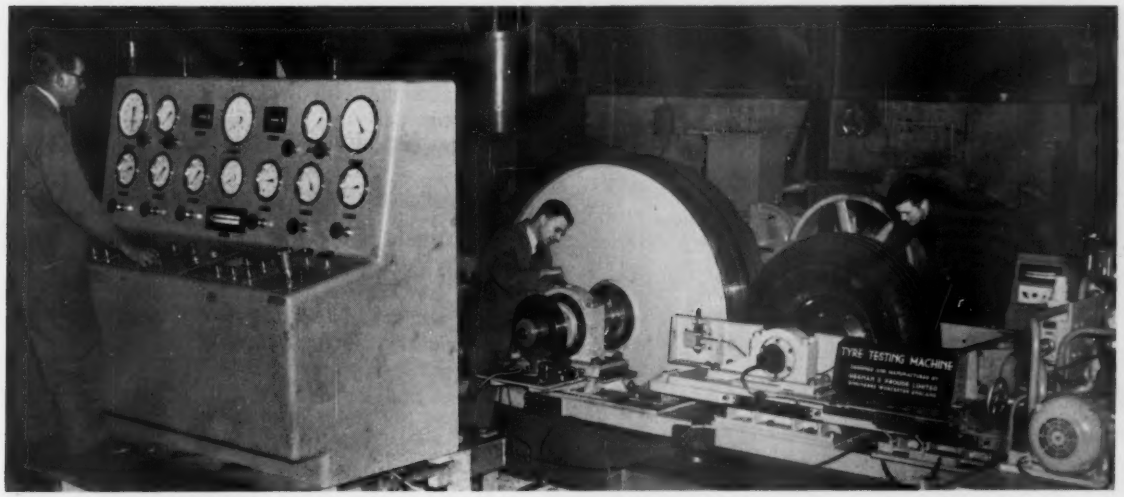

FIG. 7—Tire loads up to 15 tons can be tested on this British equipment, being supplied by Heenan & Froude Ltd., for the Russian plant.

scheme are duplicated, ensuring uninterrupted working. The equipment includes an electric machine which records the amounts weighed and the materials consumed. The accuracy of the scales is 0.25 per cent of the maximum reading of the dial scale.

All equipment for automatically controlling weighing is linked to a central control point located on the first floor of the three-story section of the stock-preparation department. The temperature of the mixing processes is also to be controlled from here.

The mixing process will be controlled by a master instrument connected to a potentiometer measuring the temperature of the rubber stock. With mixing effected at the normal temperature, the master instrument signals the stock to be discharged from the rubber-mixer at the end of a certain time. If, in the mixing process, the temperature of the stock is higher than the predetermined value, discharge of the stock is controlled by the potentiometer. In practice, under normal conditions the mixing process is controlled by the master instrument.

Testing Ordinary and Giant Tires

Heenan & Froude Limited, of Worcester, acting as sub-contractors to David Bridge & Co. Ltd., of Castleton Iron Works, Rochdale (a member of the Rustyfa Consortium), are now engaged in the manufacture of eight full-scale tire test units for use in the Russian factory at Dnepropetrovsk.

Seven of the eight machines ordered are of basically similar design, differing only in capacity and application. Of these, two are capable of testing tires by pressing them with a force of two tons each against a rotating drum, one on each side of the drum. One of these units, running at relatively slow speeds, is intended for the routine production and endurance testing of tires. The other, rated for much higher speeds, will be used for development purposes. Three larger units, capable of applying loads of up to five tons per tire, are likewise intended for routine testing and development purposes, the sizes of tires concerned ranging from those used on ordinary motor cars through those used with heavy trucks and the "giant" types.

The larger development machines may be fitted alternately with special camber drums to deflect tires from side to side during rotation, thus imposing heavy stresses on the tire walls. The drums of all the units may be fitted with slats to run tires under severe "bruising" conditions. Torque meters are used on the development machines to measure drumshaft torque. This equipment is made by Lancashire Dynamo Electronic Products Ltd., and comprises a torque tube with slotted discs at each end, a photoelectric device and phasemeter.

Two further units provide for the testing of "large giant" tires, such as are used on earth-moving ve-

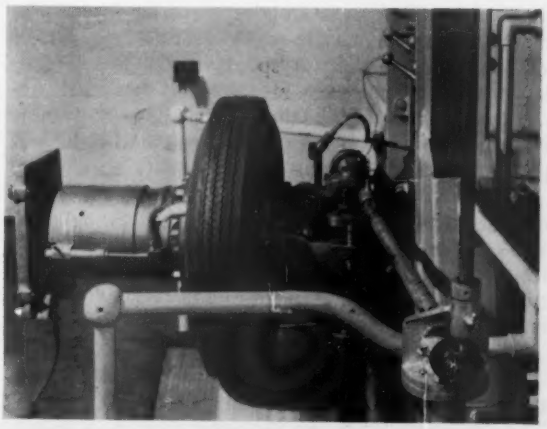

FIG. 8—One of the eight tire testing units equipped with "cornering force" mechanism for varying the steering angle and camber to simulate road conditions.

hicles. These machines have very large test drums and are designed for tire loads up to 15 tons (Figure 7).

Adjustable Hydraulic Test System

Tire loads are applied by hydraulic equipment supplied by Heenan & Froude's associated company, Fielding & Platt Ltd., of Gloucester. Hydraulic cylinder assemblies are fitted to the test wheel carriage supports, the rams being connected to the wheel carriages by a yoke arrangement incorporating hydrostatic load-measuring capsules.

The resistance of the hydraulic system may be adjusted to allow either free retraction movement of the wheel carriage during tests with a cambered drum while maintaining constant loading, or to restrict movement when testing with slats so as to produce maximum shock-loading of the tire. In the event of failure, the tire is automatically retracted to prevent further damage. For convenience of control, the hydraulic pressure can be adjusted to predetermined tire loads to suit various loading conditions and tire sizes.

The small motor-driven pumping equipment, supplying the hydraulic medium which is oil, will be placed adjacent to the main machine. Each machine is driven by squirrel cage motor, Heenan-Dynamatic Water-Cooled Coupling, and vee-belt drive for the 2-ton and 5-ton plants, worm reduction gearing being used for the 15-ton machines. The drum speed may be controlled from 5 to 80 m.p.h. by the coupling control gear. The coupling also provides a braking torque when it is required to stop the machine.

The test wheels are mounted on live spindles. Rotating pressure joints permit adjustment to and indication of tire pressure during testing. To avoid undue restriction of the capacity of machines for testing at speed, the tires are air-cooled. Two centrifugal fans per machine are used, one for each tire.

Simulating Road Conditions

The eighth unit, of an entirely different nature, consists of a Heenan & Froude "cornering force" machine. On this unit a tire is also pressed into contact with a drum, rotating at speeds up to 150 m.p.h., but special arrangements are provided to "steer" the tire across the surface of the drum while actually running, thus setting up forces very similar to those experienced when cornering on the road (Figure 8).

The unit incorporates devices for a very wide range of measurements and the kingpin angle, steering angle and camber can be varied in the course of an actual test, as can such features as speed, tire load and pressure. In addition, adjustment of tire "off-set" can be made while stationary.

The drum and the test wheel are each coupled to a Heenan D.C. Electric Dynamometer and each dynamometer is capable of absorbing or developing power. The dynamometer drives its drum through a speed-reducing gearbox, and the test wheel drives its dynamometer by a universally jointed "axle." The power needed to rotate the tire, as well as the power losses in the tire itself, can be measured.

Close control over the technical details and requirements of all eight plants has been exercised by Dunlop Advisory Services, with the help of information supplied by Dunlop's own laboratories at Erdington.

British Consultation with Russian Technicians

The above brief description is only one aspect of automation used in tire manufacture at Dnepropetrovsk. Elaborate equipment is planned in conjunction with the actual tire manufacturing process. No details about this are available yet, but it can be safely assumed that automation will be of a high order on tire presses and the like. Much will depend on the efficiency of the Russian State Planning Institute for the Rubber Industry, and on the raw materials to be supplied by various state controlled factories. By securing the advice of the Dunlop Advisory Services Ltd., know-how of the highest order is at the disposal of the factory management. Whenever "teething troubles" will arise in the use of automatic control equipment, the Russian technicians know that they can rely on assistance for overcoming trouble. The same applies to services required from the manufacturers of the automatic weighing and mixing equipment.

Judging, however, from the more than 60 daily conferences held between the consultants and the Russian engineers, the latter are very familiar with problems of automation. It has always been possible to reach agreement on the many questions arising from this very big project between adviser and future users. Part of the duties of the consultants included supervision of plant, machinery and automatic control equipment during course of manufacture in various British factories. This at least makes sure that the Russian factory receives first class equipment, and it will be up to factory management that well-trained technicians and workers operate the elaborate machinery installed.

ACKNOWLEDGEMENT

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The sketches and description of the automated stock preparation department are reproduced by courtesy of "Kauchuk i Rezina," a journal of the State Committee on Chemistry of the U.S.S.R. Council of Ministers, Moscow. Permission has also been given to excerpt an English translation which appeared in the January 1957 issue of this journal, published by the Research Association of British Rubber Manufacturers under the auspices of the Translation Unit of the Department of Scientific Industrial Research, London (Translator: M. Lambert, B.A.).

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Characterization of

PVC Resins

by the Conductivity of Solvent Extract

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FIG. 1—Dip cell used in conductivity measurements consists of two platinum electrodes within an insulating chamber which serves to isolate a portion of the liquid.

FIG. 2—After PVC resin particles settled and the temperature approached 25° C., conductivity was tested with this cell immersed in the extract so that the electrodes were covered.

PLASTICS based on poly(vinyl chloride) resin have gained wide acceptance as electrical insulation for wire and cable. To establish whether a resin has suitable electrical properties, it is customary first to compound it and make measurements on a molded slab. The heat sensitivity of the resin makes compounding a prerequisite to molding. This method of evaluation is time consuming and has the additional drawback of introducing compositional as well as processing variables. A need exists for a direct method of distinguishing between electrical and non-electrical resins prior to formulation.

An approach to this problem employing electrolytic conductivity measurements on extracts of poly(vinyl chloride) resins has been investigated in ASTM Committee D-20 on Plastics *(1)*. A relationship has been shown to exist between slab resistivity and extract

Note: This paper was presented at the 16th Annual Technical Conference of the Society of Plastics Engineers, in Chicago, Ill., January 12-15, 1960.

conductivity measurements that should be useful in predicting the electrical properties of the resin per se. Four different extraction methods have been screened in round robins for the purpose of refining technique and the standardization of a single test procedure. The data reported here are mainly a summary of the results obtained in these ASTM round robins.

The value of conductivity measurements in evaluating insulating materials such as paper and textiles has been appreciated for some time. Selection of a textile according to Walker *(2)* should include consideration of the amount of electrolytes present as determined by the a-c conductance of a water extract. Similarly, Finch *(3)* has stated that for insulating paper, certain characteristics such as water-soluble salt content should be controlled if a satisfactory permanence under electric potential were to be obtained, and mentions water extract conductivity as an efficient means of doing this.

Detecting Ionic Impurities

The principle involved in characterizing resins by an extract conductivity method is based on the assumption that the predominant factor determining compound electrical behavior is the ionic content of the base resin. It is further assumed that the contaminants are not a part of the polymer structure, which is covalent and inherently resistant to ionization; and that treatment of the virgin resin with a suitable nonsolvent will result in extraction of the ionic impurities. The resulting increase in the conductivity of an extractant such as water or isopropanol should, therefore, be a measure of the purity of the resin and form a basis for predicting compound behavior.

Possible sources of ionic impurities during the manufacture of the resin may be equipment contamination, dispersing agents, catalysts or the water used in the polymerization system. Also during polymerization, some of the vinyl chloride polymer may break down, releasing a small amount of HCl which may be absorbed on the resin particle giving rise to another source of ionic impurity.

Another means that might be used for detecting ionic impurities is electrometric determination of the hydrogen ion concentration, pH, of aqueous extracts. Maltese and Gioacchino describe a procedure that differentiates between various types of vinyl chloride homopolymers. Those prepared in suspension are reported as having pH values of 6.2-6.9, those in emulsion 6.7-7.2, and those in emulsion in the presence of an alkaline buffer 8.4-10 *(4)*. The pH method, however, does not appear as attractive for control purposes as conductivity because of the more elaborate technique and special apparatus required to obtain reproducible results.

Resins and Extractants for Study

Six poly(vinyl chloride) resins with a wide range of electrical properties were selected as the principal materials for study. Comprising two resins from each of three suppliers, they were representative of available commercial types. All of the resins were homopolymers with a nominal chlorine content of 57 per cent, a density of 1.4, and an inherent viscosity range of 1.08-1.24 as measured in cyclohexanone at 30° C. in accordance with ASTM D 1243 *(9)*. All of the general purpose resins, including the special No. 4 sample that resists wetting by water, were authorized by Underwriters Laboratories, Inc., as interchangeable resins for "Recognized Compounds" in insulation on appliance wiring material *(10)*. Of the dispersion resins, only No. 1 was suggested by the supplier for electrical applications.

A high-purity water having a maximum conductivity of 2.5 micromhos/cm was used for all aqueous extractions. Water of this purity is required in order to distinguish between the various resins, many of which have very low conductivities. A purity of this order is readily obtainable by careful distillation *(11)* or by a system of distillation and ion exchange resins. One suitable procedure is to pass ordinary distilled water through a mixed bed ion exchange column of Amberlite MB-1 (Rohm & Haas). Water from this system may be expected to range from 1.5-2.0 micromhos/cm.

Where isopropanol was the extractant or wetting agent, an ACS reagent grade was used with a conductivity value on the order of 0.22 micromhos/cm. This solvent readily wets all types of resins and also markedly lowers the surface tension of water when added in small percentages.

Four Extraction Methods

The three extraction methods submitted by participating laboratories, as well as the fourth method developed by the Task Group, are described below. An acid and alkali-resistant glassware is preferred for carrying out the extractions, although Pyrex has been used and found satisfactory. A necessary precaution prior to using any glassware was to rinse it several times with boiling, high-purity water.

Method 1: Isopropanol is used as the sole extractant in this method. A 10 ± 0.2 g sample is put into a 160 ml wide-mouth bottle, and 100 ml of isopropanol added. The bottle is closed with a metal cap lined with polyethylene, shaken briefly and revolved on a shaft for one hour at 22 rpm in an oven at 60° C.

Method 2: A water extract is obtained by this method after prolonged refluxing. A 10.0 g sample weighed on a torsion balance is refluxed for one hour near boiling with 100 ml of water in a 400 ml flask. The resin is then allowed to settle and the supernatant liquid decanted.

Method 3: A water extract is obtained which subjects the resin to boiling for a short time. A $1\pm.0005$ g sample is poured into a 250 ml flask and 100 ml of boiling water added. A watch glass is placed over the mouth of the flask and the contents boiled for 5 minutes.

Method 4: The feature of this method is that the resin is first wetted with a small amount of isopropanol. A $2.000\pm.0005$ g sample is transferred to a 250 ml flask; 5 ml of isopropanol is added and the

TABLE I—SPECIFIC RESISTIVITY OF PLASTICIZED POLY(VINYL CHLORIDE) TEST SLABS†

Participating Laboratory	50° C., Dry Specific Resistivity, ohm/cm — General Purpose Resins (GP) 1	GP 2	GP 3	Dispersion Resins (D) 1	D 2	D 3	
A	119×10^{12}	318×10^{12}	42.8×10^{12}	66.0×10^{12}	0.003×10^{12}	0.008×10^{12}	
B*	55	400	30.0	30.0	0.003	0.006	
C	1,210	220	105.0	77.0	0.009	0.023	
D	99.5	93.8	51.7	31.4	0.017	0.005	
E	>350**	310	>355**	0.6	0.070	0.002	
Average, $\overline{X}$	371×10^{12}	268×10^{12}	55.9×10^{12}	41.0×10^{12}	0.02×10^{12}	0.009×10^{12}	
Stand. Dev., σ	485	105	31.4	27.4	0.03	0.007	Avg.
% Coef. of Variation, (σ/X 100)	131	39.2	59.7	66.8	150.00	77.800	87.4

* Data taken at 23° C and adjusted with temperature factor to 50° C.
** Not averaged.
† Test formulation:

	Parts by Wt.
Poly(Vinyl Chloride) Resin	100
Dioctyl Phthalate Type Plasticizer	50
Basic Lead Carbonate	10
Calcined Clay	7

Milling Conditions: 15 minutes at 136° C.

mixture swirled to obtain a uniform slurry. Then, 100 ml of boiling water is slowly added, a watch glass placed over the mouth of the flask, and the contents boiled for 5 minutes.

Making Conductivity Measurements

The conductivity measurements on resin extracts are made with a dip cell and an a-c Wheatstone bridge. A cell having a constant of approximately 0.1 reciprocal cm of the type shown in Figure 1 is used. The cell consists of two platinum electrodes spaced within an insulating chamber which serves to isolate a portion of the liquid. The electrodes are coated with a deposit of spongy platinum which, by increasing the effective surface, reduces the polarizing effect.

Detailed procedures in platinizing and calibrating dip cells are described in paragraph 81 of ASTM D 202 "Tests for Insulating Paper" *(9)*. Calibration involves measuring the resistance between the electrodes when immersed in a 0.01 molar potassium chloride solution whose conductivity is 1.41×10^{-3} mhos per cm at 25° C. The cell constant, K, is calculated as follows:

$$K = C \times R \quad \left[\begin{array}{l}\text{where } R = \text{resistance in ohms} \\ \quad\quad C = \text{conductivity of KCl solution}\end{array}\right]$$

For making the resistance measurements on the extracts, an a-c Wheatstone bridge is used having a range of 1 to 250,000 ohms measured resistance, with a built-in potentiometer, a 1000 ± 50 cycle per second oscillator, and a sensitive null-point indicator. The resistance measurements should be accurate to at least $\pm$ 2 per cent. Alternating current is used in these measurements to minimize polarization effects.

The terminology in the field of solution conductivity measurements and the manner of expressing results is well standardized *(12)*. In this study, measurements are expressed as either resistivity or conductivity. This is equivalent to correcting all readings to correspond to a solution specimen of 1 cm cube. The units of conductivity are the reciprocal ohm-cm or mho/cm, and one millionth of this or micromho/cm.

For all extracts, except those in Method 2 which are decanted, the conductivity of the extracts were measured in the same vessel in which the extract was prepared. After the resin particles have settled and the temperature is at 25 ± 5° C., the dip cell is immersed in the extract so that the electrodes are completely covered (Figure 2), and the resistance immediately measured. Although 25° C. was used in this investigation, when the method is eventually standardized the laboratory temperature of 23 ± 0.5°C. per ASTM D 618 will be specified *(9)*. From this measurement, the conductivity in micromhos/ cm is calculated in the following manner:

$$\text{Conductivity micromhos/cm} = (K/R_x - K/R_b) \times 10^6$$

$$\left[\begin{array}{l}\text{where } R_x = \text{resistance of extract, ohms} \\ \quad\quad R_b = \text{resistance of blank, ohms}\end{array}\right]$$

The Round Robin Program

The interlaboratory program, undertaken to determine the correlation of resistivity with extract conductivity required the preparation of compounds containing the resins to be studied and measurement of their electrical properties. The use of slab resistivities for determining the electrical characteristics of vinyl plastics has been described by Fuoss *(5 and 6)*, and more recently by Ashworth et al, *(7)*, and Balmer and Conyne *(8)*. The latter state that slab values correlate well with the insulation resistance of wire at room temperature.

The experimental compounds in this program were all prepared in one laboratory and milled sheets were distributed for measurement to the five participating

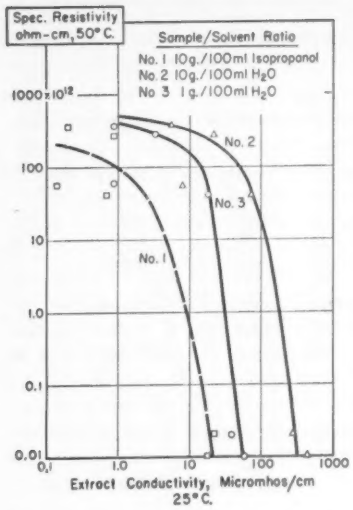

FIG. 3—Extract conductivity of PVC resins from three procedures is plotted against their dry slab resistivity.

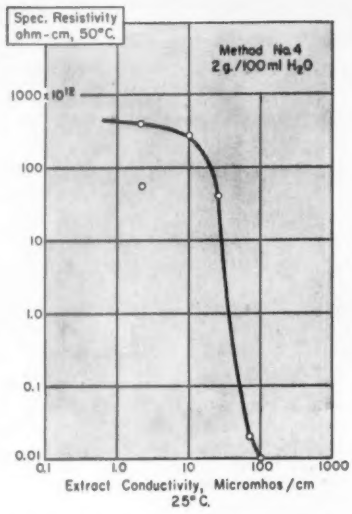

FIG. 4—Extract conductivity of PVC resins obtained by the water/isopropanol method also vs. dry slab resistivity.

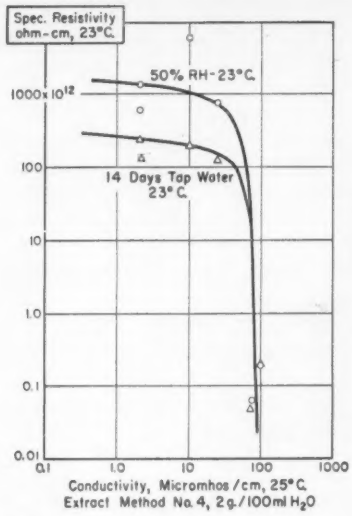

FIG. 5—Measurements for dry samples are compared with values for slabs immersed 14 days in tap water at 23° C.

laboratories. The instructions were to measure the slabs dry at 50° C. in accordance with ASTM D 257-58, "Test for Electrical Resistance of Insulating Materials" *(9)*. The test formulation and data obtained are listed in Table I.

Conductivity data on extracts from the four different extraction methods were obtained in interlaboratory tests and examined for correlation with slab resistivities. The first three methods examined were submitted by participating laboratories that had some experience in their use. None of these were entirely satisfactory in interlaboratory round robins, and a fourth and more universal method was evolved that was generally acceptable to all participants. These results are given in Tables II and III.

Significance of Resistivity Values

On the basis of the electrical measurements that were made on the experimental insulating compounds, the six test resins may be classified as either high or low resistivity types. The high type yields values on the order of 10^{14} ohm/cm at 50° C. and the low ones values of 10^{10} ohm/cm. General Purpose Resins No. 1, 2 and 3, and Dispersion Resin No. 1 comprised the group with high values, while Dispersion Resins No. 2 and 3 formed the low ones. The order within either group is somewhat doubtful because of the wide range of values on which each average is based cf. data in Table I.

The manner in which extract conductivity varies with slab resistivity may be seen by referring to the curves in Figures 3 and 4. Here the conductivity of the six resins obtained by the various extraction methods, has been plotted against their dry slab resistivity. The shape of the curves is essentially the same for all methods; only displacement to the left or right occurs depending upon sample size or solvent. Resins having a low conductivity value show the highest resistivity and vice versa.

Differences in extract conductivity do not become an important factor until a critical level is reached, above which a marked loss in resistivity takes place. For a 10 g sample in 100 ml of isopropanol (Method 1), this occurs at about 5 micromhos/cm, while for the same size sample in water it is about 100. The lower value obtained with isopropanol is probably due to a different degree of ionization in this solvent. Any of the four extraction methods might be used to characterize a resin, the choice resting primarily on convenience of manipulation and reproducibility.

The above observations are also found to hold for wet measurements at room temperature. In a side experiment by one laboratory, the resistivity measurements of Table IV were obtained on slabs after 7 days' immersion in tap water at 23° C. Like data with dry values at the same temperature are plotted in Figure 5 against conductivities by extraction Method 4. Despite their different starting levels, the wet and dry curves both show an inflection in the same region.

The critical level of impurities that may be tolerated in a resin will vary somewhat with the composition of the compound. Stabilizing ingredients or fillers may act as sequestering agents for impurities to produce this effect. To achieve correlation with resistivity measurements, Engle states that it is sometimes desirable to add 0.1 g basic silicate of white lead and 0.2 g barium stearate to the resin prior to extraction *(13)*. The result obtained with Dispersion Resin No. 1 appears to be an example of this effect. The resin shows resistivity values equivalent to that of the UL interchangeable resins despite its definitely higher extract conductivity. Apparently one or more of the ingredients in the test formulation are capable of immobilizing impurities up to this level. Where the

amount of ionic impurities is extremely high, exceeding what may be complexed as in the case of Dispersion Resins No. 2 and 3, low resistivities result.

Varying Extraction Procedures

Variation in the extraction procedure had a marked effect on the agreement in conductivity measurements obtained among laboratories. The agreement for Methods 1 and 2 were much poorer than that for Methods 3 and 4. This is reflected in the over-all coefficients of variation which were 67.5 and 39.1 per cent, respectively, for the first two methods; 18.3 and 20.7 for the latter two. A partial explanation for the results observed for Methods 1 and 2 may be the extra operations and/or the special equipment required. In contrast, Methods 3 and 4 called for only a minimum of handling and equipment. For these reasons, and that of wettability mentioned below, Method 4 was the most satisfactory procedure found for general use.

The all-aqueous Methods 2 and 3 were criticized because of the incomplete wetting attained with certain resins, particularly General Purpose Resin No. 4. This resin coated the sides of the container and formed agglomerates on the surface of the liquid. A number of additives were tried that might be used in small amounts to improve wetting without seriously impairing the high conductivity of the water. The desired results were obtained with a nonionic wetting agent Igepal CO-630 (General Dyestuff Corp.) and with isopropanol.

The procedure in using each wetting agent is important. In the case of the Igepal, first 10 ml of water is added to a 2 g resin sample, then 3 drops of a 10 per cent aqueous solution of the concentrate. The mixture is swirled to form a slurry. Next, the remainder of the water is added, the extraction then performed in the prescribed manner. With isopropanol, 5 ml of alcohol is added as has been described for Method 4.

A water blank of 1.85 micromhos/cm measured 2.25 after the addition of Igepal and 2.55 for isopropanol. The choice of isopropanol over Igepal in Method 4 was made because no special solution had to be prepared and the alcohol was easily available in most laboratories. The effect of the isopropanol on extract conductivity was to produce a slight increase, which is what would have been expected from more efficient extraction. This may be seen from a comparison of the control tests in Table III where isopropanol was omitted.

Drift, Time and Sample Size

Drift during measurements was another previously noted problem, but attempts to deliberately reproduce it were not successful. Cell immersion times ranging from 0.5 to 5.0 minutes did not show any drift that would seriously affect results.

An increase in extraction time from 5 to 15 minutes is shown by Table III to raise the conductivity between 5 and 15 per cent. The extraction time must be controlled, but a time of 5 minutes, if used, does

TABLE II—CONDUCTIVITY OF PVC RESIN EXTRACTS FROM FIRST AND SECOND ROUND ROBINS

Extraction Method Designation	Sample/Solvent	Participating Laboratory	Extract Conductivity, micromhos/cm, 25° C. General Purpose Resins No. 1	No. 2	No. 3	Dispersion Resins No. 1	No. 2	No. 3	
No. 1*	10 g/100 cc	A	0.01	0.15	0.02	0.20	15.8	11.6	
	Isopropanol	B	0.23	0.54	0.13	0.42	14.4	11.0	
	(1 hr. at 60° C.)	D	0.27	2.09	0.28	1.47	32.4	30.2	
		Avg. $\bar{X}$	0.17	0.93	0.14	0.70	20.9	17.6	
		Stand. Dev., σ	0.11	0.85	0.11	0.55	8.2	8.9	Avg.
	% Coef. of Variation (σ/X 100)		65.00	92.00	79.00	79.00	39.0	51.0	67.5
No. 2**	10 g/100 cc H_2O	A	12.9	50.0	12.2	89.4	307.8	444.3	
		C	1.3	0.8	5.5	69.4	278.5	449.4	
	(1 hr. at 100° C.)	B	3.0	19.0	7.0	71.0	261.0	412.0	
		Avg. X	5.7	23.3	8.2	76.6	282.5	435.2	
		Stand. Dev., σ	5.0	20.3	3.0	9.1	18.8	16.6	Avg.
	% Coef. of Variation (σ/X 100)		88.0	87.0	37.0	12.0	6.7	3.8	39.1
No. 3**	1 g/100 cc H_2O	A	0.72	3.5	0.72	22.2	40.2	60.5	
	(5 min. at 100° C.)	B	0.83	2.7	<0.10†	17.5	42.4	64.7	
		C	0.60	3.3	1.20	17.0	38.0	56.0	
		D	1.50	4.1	1.50	17.8	38.8	57.5	
		Avg. $\bar{X}$	0.90	3.4	0.90	18.6	39.9	59.7	
		Stand. Dev., σ	0.35	0.5	0.32	2.1	1.7	3.2	Avg.
	% Coef. of Variation ($\sigma/\bar{X}$ 100)		39.00	14.0	36.00	11.0	4.3	5.4	18.3

* First round robin data, Sec. H, Sub. XV, ASTM Committee D-20, October, 1958.
** Second round robin data, Sec. H, Sub. XV, ASTM Committee D-20, February, 1959.
† Not averaged.

not appear to be on a critical portion of the time/extraction curve.

In Table V the conductivities from Methods 2, 3 and 4, in which samples of 10, 1 and 2 grams were respectively used, are expressed on a uniform basis of micromhos/cm per gram of sample. No definite trend is discernible between 1 and 2 gram samples, but there is a drop from all six resins with a 10 gram sample. Because of procedural differences among these methods, the observations should be viewed only as an approximation of the trend. More precise information on the effect of sample size in isopropanol has been reported by Engle, who found the logarithm of resistivity of the extract to be a linear function of the square root of the sample size *(13)*.

The precision to be expected from any set of conductivity measurements will depend upon their magnitude and source. At the low end of the conductivity scale—from 0 to 15 micromhos/cm—the 95 per cent reproducibility limits are within ± 1.0 micromhos/cm for replicates from one laboratory and within ± 2.0 micromhos/cm for those from more than one source. This is the range in which most measurements will be made, since it encompasses the majority of electrical grade resins. Where values approach 100 micromhos/cm, as for nonelectrical grades of dispersion resins, limits of the order of 10 micromhos/cm may be expected. The above estimates of precision are based on 2 σ values taken from Method 4 data in Tables III and VI.

Test Results in Summary

Interlaboratory tests have shown that by means of electrolytic conductivity measurements on extracts of poly(vinyl chloride) resins, it is possible to distinguish between electrical and nonelectrical grades. The resistivity of a typical vinyl insulating stock was found to decrease sharply when resins with high extract conductivity were used.

The test is rapid, requiring only conventional apparatus, and fills the need for a method of screening resin prior to compounding. The results of round robin studies on four different methods showed the most suitable to be one employing isopropanol as a wetting agent and high purity water as the primary extractant.

ACKNOWLEDGEMENT

The authors wish to thank ASTM Committee D-20 for its permission to release the information associated with this program. The various round robin data were collected by a task group of Section XV H. The authors are particularly grateful to the suggestions and constructive criticism that they received from their colleagues on this group who included P. J. Adams, Monsanto Chemical Co.; D. L. Engle, Union Carbide Chemical Co.; K. K. Fligor, Goodyear Tire and Rubber Co.; and J. L. Hutson, General Tire and Rubber Co.

Appreciation is also due to J. M. Quint of B. F. Goodrich Chemical Co., as well as to H. M. Zupko

TABLE III—CONDUCTIVITY OF PVC RESIN EXTRACTS FROM THIRD ROUND-ROBIN

METHOD No. 4 (except as noted): 2 gram resin sample wet with 5 cc isopropanol, extracted 5 min. in 100 cc boiling water.

Participating Laboratory	Extraction Time, Min. at 100° C.	Extract Conductivity, micromhos/cm, 25° C. — General Purpose Resins 1	GP 2	GP 3	GP 4	Dispersion Resins 1	D 2	D 3	D 4	
A	5	1.4	11.1	1.3	2.6	29.6	79.1	99.5	—	
	no isopropanol 5**	—	—	—	2.0	—	—	104.7	—	
B	5	3.2	11.0	1.4	2.2	26.1	74.8	101.6	—	
	no isopropanol 5**	2.0	10.8	—	2.1	—	—	—	—	
	15**	3.4	12.2	—	3.2	—	—	—	—	
D	5	2.9	9.4*	3.7	—	25.9*	70.8*	91.9	—	
E	5	1.2	9.1	2.2	2.4	21.8	65.3	97.4	84.7	
	Average, X	2.1	10.2	2.2	2.4	25.9	72.5	97.6	—	
	Stand. Deviation, σ	1.1	0.8	1.0	0.2	2.8	5.1	3.6	—	Avg.
	% Coef. of Variation ($\sigma/\bar{X}$ 100)	50.0	8.1	44.8	7.2**	10.7	7.0	3.7	—	20.7

* Different lot of resin from that reported in Table II. ** Not averaged.

TABLE IV—SPECIFIC RESISTIVITY OF PLASTICIZED POLY(VINYL CHLORIDE) TEST SLABS, OHM/CM
(Data from Laboratory "B")

Pre-Conditioning of Test Slabs	Test Temperature 23° C. — GP No. 1	GP No. 2	GP No. 3	D No. 1	D No. 2	D No. 3
2 days at 23° C. and 50% Rel. Hum.	1500×10^{12}	6000×10^{12}	650×10^{12}	800×10^{12}	0.07×10^{12}	0.20×10^{12}
2 days Tap Water Immersion, 23° C.	510	320	190	130	0.07	0.20
7 days Tap Water Immersion, 23° C.	260	200	140	130	0.05	0.20

TABLE V—CONDUCTIVITIES FOR DIFFERENT SIZE EXTRACTION SAMPLES EXPRESSED ON A UNIFORM BASIS

Resin		Micromhos/cm per Gram of Sample 1 g Sample	2 g Sample	10 g Sample
General Purpose	No. 1	0.9	1.1	0.6
	No. 2	3.4	5.1	2.3
	No. 3	0.9	1.1	0.8
Dispersion	No. 1	18.6	13.0	7.7
	No. 2	39.9	36.3	28.3
	No. 3	59.7	48.8	43.5

TABLE VI—REPLICATE CONDUCTIVITY DETERMINATIONS FROM LABORATORY "E" USING EXTRACTION METHOD NO. 4

Day	Micromhos/cm, 25° C. General Purpose Resins 1	2	3	4
1	0.72	8.70	1.80	3.00
	0.78	8.40	1.70	2.80
2	1.90	9.70	2.30	2.30
	1.90	9.70	2.80	2.50
3	0.75	——	——	1.70
	0.90	——	——	1.80
Average, X	1.16	9.13	2.15	2.35
Stand. Dev., σ	0.52	0.50	0.45	0.48
% Coef. of Variation, ($\sigma/\bar{X}100$)	44.80	5.50	20.90	20.40

and J. Demchik of Bell Telephone Laboratories, for their assistance in obtaining experimental data and in preparing the manuscript.

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Coming Soon . . .

Improved Butyl Rubber Vulcanizates—By C. J. Jankowski, K. W. Powers and R. L. Zapp, Enjay Laboratories, Linden, N. J.

How superior butyl rubber vulcanizates are obtained by replacing normal sulfur loading and accelerator with sulfur donor and low sulfur—high accelerator vulcanization systems.

Engineering Factors in Coating with Silicone Rubber for High Temperatures—By H. I. Silversher, R. C. Shaffer and R. A. Landry, Western Backing Corp., Culver City, Calif.

When glass cloth is combined with a silicone compound, the resulting product derives mechanical strength from the glass in addition to flexibility and protection from the rubber.

The Role of Carbon Black in the Thermal Oxidation of Polyolefins—By W. Lincoln Hawkins, Bell Telephone Laboratories, Murray Hill, N. J.

The ability, exhibited by many carbon blacks, to inhibit the free radical oxidation of polyolefins is dependent on the presence of certain reactive groups on the surface of the carbon particles. Heating in the presence of oxygen or sulfur increases the number of reactive groups to produce a much more effective antioxidant.

PLUS R/A SPECIAL INDUSTRY REPORT

Auto Fleet Leasing in the Rubber Industry—Your Questions Answered

A series of 12 questions and answers point up the extent to which leasing has been accepted by the rubber industry and spotlight some of the pros and cons of switching from company-owned fleets.

FIG. 1—For this wire-to-rubber adhesion test, wires are placed between two rubber pads and mounted between reinforcement plates. After curing and overnight cooling, the wire is pulled from each sample by a tensile tester that records the requisite force.

Wire Makes Stronger Rubber Products

By WILLIAM PEACE

Vice-President, National-Standard Co., Niles, Mich.

WIRE has been a product component used by rubber fabricators ever since it was first introduced to keep carriage tires from slipping off their rims some 80 years ago. Evolution of new rubber compounds over these years has been paralleled by new metallurgical features and surface finishes. Together, improved rubber and wire have made possible an amazing array of rubber products.

Wire lends many desirable characteristics to rubber. First, it adds rigidity. For example, wire in a tire bead keeps the bead diameter constant and resists the distending effects of inflation pressure, centrifugal force and vehicle load. Wire maintains constant length in vee-belts and drive belts for power transmission, permitting greater load distribution with less wear or adjustments. Coiled wire prevents radiator and vacuum hoses from collapsing because of vacuum inside the rubber hose. Wire breaker layers just under tire treads prevent undue flexing.

Second, wire in rubber products absorbs shocks. In tire beads it carries road shock. Wire braid in high-pressure steam, air and hydraulic hoses takes up all the shock and vibration of the system. Solid metallic tubing has given way to wire-reinforced rubber hose in applications where fatigue runs high: such as highway tractor-trailer connections, aircraft systems, and suction lines attached to mechanical pumps.

Third, wire adds heat conductivity to rubber products. Heat is carried away from wearing surfaces in tires and belts by embedded wire to prevent destruction of rubber from high concentrations of heat.

Fourth, wire adds electrical conductivity to rubber goods. Electrical conductivity is important in carrying off static in gasoline hoses, tires and other installations.

The oldest large-scale use of wire in rubber is in automotive tires. Problems of stretching in rubber tires were multiplied by the switch from solid to pneumatic tires. Wire reinforced beads came into use by 1890. Then, as now, the weight of a rubber-tired vehicle was borne by the rims. A strong steel grommet made of wound wire was built into the tire bead to anchor the plies against the rim and to overcome the tendency of internal pressure to raise the tire edge over the rim.

Four Types of Basic Bead Wire

Four types of bead wires have survived the test of time: flat braid, tape, weftless and single-wire.

Flat braided wire is made up of an odd number of wires braided together and then wound into the bead grommet. Flat braid is used today for special aircraft and butyl tires (as well as pressure hoses), where strong mechanical adhesion to the bead compound is available in addition to chemical adhesion.

Tape bead wire is made up of parallel wires with a smaller filler wire woven back and forth. Tape bead offers good mechanical adhesion and is used in passenger car and truck tires. Pierce tape, manufactured by National-Standard, is designed to ensure equal distribution of tensile loads among the parallel wires, making it especially useful where high strength is

needed. A standard adhesion test is illustrated in Figure 1.

Weftless bead wire is made up of parallel wires bound together only by a rubber compound. This type has practically no mechanical adhesion, since there are no interstices such as those in braid or tape. It is most popular for passenger cars today, because inventory is simplified with one wire size available for nearly all tire sizes.

Single-wire bead is made up of a single, rubber-covered wire. Its most important use today is in hexagonal beads being developed for metal-ply truck and bus tires. Bead grommets are made up of sufficient braid, tape, weftless or single-wire layers to obtain hoop tensile strengths of several thousand pounds. Physical properties of bead wire are given in Table I.

Bead wire diameters have varied throughout the history of tire design, but 0.037-in. is most often specified today for weftless, tape or single-wire bead grommets. Braid grommets are usually made of 0.025-in. or 0.028-in. wire, from high-carbon steel (0.40 to 0.85 per cent carbon) because of its high tensile strength. Figure 2 shows how beads are tested for passenger and truck tires.

Balancing Adhesion and Tensile Strength

In tires—as in most other wire-reinforced rubber goods—mechanical and chemical adhesion between the two materials is as important as wire strength. Mechanical strength comes from the interlocking of rubber in and around the spaces between the wires in braid or tape. As rubber is forced through the insulating head, around the braid or tape, it fills all these spaces and interlaces the bead wire. Since weftless and single-wire bead grommets are interwoven, mechanical adhesion is a minor factor for them.

Chemical adhesion is a bit more complex and depends greatly on surface finish and compounding. The basic mechanism of chemical adhesion requires copper in the finish and sulfur in the rubber to form copper sulfide. This process sets up subatomic valence forces at the interface of the rubber and wire that lock them.

The sulfur remains within the rubber, the copper stays on the wire, while the copper and sulfur are bound in copper sulfide at the interface. Copper content ranges from 0.035 to 0.125 per cent by weight of total wire, and must be carefully controlled with regard to the specific bead compound to avoid too rapid curing of the rubber.

Several finishes are widely used to furnish the copper required for chemical adhesion of wire to rubber. Each finish has its own combination of adhesion effectiveness, corrosion resistance and cost.

Finishes for Specific Copper Content

AP-1 finish (National-Standard Co.) provides copper for chemical adhesion in the form of electroplated copper on a zinc coating over the wire. The zinc is bound to the wire by the galvanizing process. The copper binds simultaneously to the zinc through the plating, and to the rubber through the copper sulfide formation. The combination of galvanizing and copper plating provides good chemical adhesion with excellent corrosion resistance. Resistance to corrosion is important if natural rubber is used, because of its porosity which might allow water to reach the bead wire. Corrosion tests are performed in a controlled temperature and humidity chamber (Figure 3).

BP finish provides copper for chemical adhesion through bronze (copper-tin) plating on the bead wire. This finish gives good adhesion with less corrosion resistance than AP-1 finish.

Liquor finish provides chemical adhesion through precipitation of copper and tin on the wire surface. It offers good adhesion for tire bead (and for hose), but less corrosion protection than AP-1 finish.

Brass-plated bead wire provides copper through the brass (copper-zinc) plate and offers very good adhesion for all rubber stocks. It has corrosion resistance comparable to BP finish.

These four finishes—AP-1, BP, liquor, and brass-plate—offer a range of chemical adhesion characteristics that can be varied individually to meet the needs of individual rubber compounds. Each finish can be tailored to actual samples of the insulating compound to avoid the minute variations in rubber composition that can produce widely varying results with a given finish.

Producing and Testing Adhesion

In modern tires, the widely used single-wire or weftless grommet depends almost entirely on chemi-

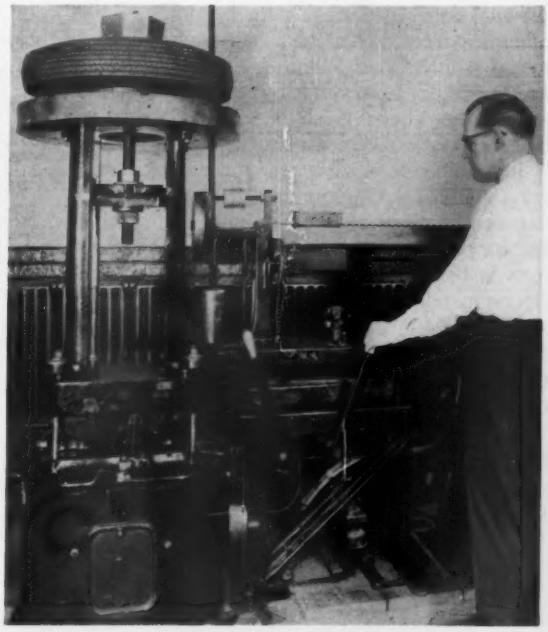

FIG. 2—This equipment in National-Standard's Akron, Ohio, plant is a "bulldozer" bead tester that breaks beads in passenger and truck tires to determine their tensile strength. Wedge shaped segments spread outward until the bead breaks. The test is recorded in graph form.

FIG. 3—Temperatures from 40° to 170° F. and relative humidities from 34 to 98 per cent can be set in this controlled humidity chamber for corrosion testing of wire finishes and coatings. Tests may run hours or months.

cal adhesion since grommet wires offer little mechanical adhesion. In designing for maximum adhesion in other products, top mechanical adhesion can be obtained with a braid having a bronze plated or AP-1 finish. Often, however, a wire braid with the more economical liquor finish is suitable because of the inherently high mechanical adhesion of braid.

Laboratory tests have been developed by individual wire makers to provide reproducible data on adhesion between specific rubber compounds and specific wires. Industry-wide correlation and standardization of these tests is being fostered under the auspices of ASTM. Recommended standard tests are expected in 1960.

Two criteria are required in evaluating adhesion: first, pounds of pull required to break the bond; second, visual inspection to determine whether the bond or the rubber is stronger. If rubber is seen on the wire after they are pulled apart, adhesion probably can be improved by changing the compound.

Table II shows results for typical tests of rubber adhesion to 0.037-in. wire with various finishes. The rubber stock was cured for one hour at 260° F. Test pads were stored 20 months after vulcanization before the tests were made.

Coverage figures refer to per cent of wire covered by stock after separation. Higher percentage figures indicate that separation occurred principally because the compound tore before the bond was broken. Better adhesion could be obtained in these instances by improving the compound. Low coverage figures, on the other hand, indicate that better results could be obtained by substituting a different wire finish.

Lab Research Leads the Way

Adhesion and corrosion studies are conducted by wire makers at the request of rubber manufacturers upon samples furnished by them. The wire maker's laboratory provides full reports of the tests, working with the compounds that rubber manufacturers submit. The story behind the AP-1 finish typifies the role played by such laboratories. In 1926, the Pierce tape (developed by R. C. Pierce at B. F. Goodrich Co., then produced by National-Standard Co.) was devised to provide greater rigidity than that of flat braid. Tinned wire was used first. A liquor finish was substituted later, but corrosion during transportation and storage remained a major problem.

Extensive research produced no satisfactory results until 1932, when Edward L. Avery, who had developed a process for putting a copper coating over galvanized wire, began to work on this problem. His method could not be adapted to commercial use but formed the nucleus for a practical process. Mr. Avery had several other processes in mind at the time, so his zinc-copper coating method was named "Avery Process No. 1" or "AP-1."

The first commercial shipment of AP-1 was sent to the Yokohama Rubber Co. (Japan) in 1932. The wire made the sea trip without corroding, solving the problem that had caused particular concern among Japanese engineers. Although developed for use with Pierce tape, this finish proved equally useful for other reinforcing applications of wire in rubber where high degrees of adhesion and corrosion resistance were required.

Some rules of thumb are available to guide designers in specifying a wire that will combine needed strength with desired adhesion and corrosion-resistance. Calculating the strength of reinforcing wire required for a given application requires knowledge of physical properties such as those listed in Table I.

Tolerances in wire size have a significant effect upon cost. When a fabricator requests wire of unusually close tolerances, extra costs in drawing develop. In many cases these costs can be eliminated by designing the rubber product to permit use of a standard tolerance.

Another cost-saver is the use of extra large coils of wire made possible recently by improved drawing and packaging techniques. Large coils reduce machine downtime and speed unloading of incoming shipments, yet are easily moved by fork trucks.

Ordering large quantities also permits savings due to the economies inherent in longer runs. Vacuum packing permits storage of bead wire indefinitely with perfect preservation of its finish. In this packaging system the coils are sacked in a polyethylene bag and the air evacuated.

A desiccant is inserted to take up all residual moisture, and the polyethylene bag is then sealed. The sealed bead wire is wrapped and strapped to one-way pallets, ready for shipment and indefinite storage.

TABLE I- PHYSICAL PROPERTIES OF STEEL WIRE

Steel Wire Ga. No. W. & M.	Diameter in Inches	Area in Square Inches	Breaking Strain 100,000 Lbs. Per Sq. In.	Weight, Pounds Per 1,000 Ft.	Feet Per Pound
	.0010	.00000079	.079	.00267	374924
	.0012	.00000113	.113	.00384	260364
	.0014	.00000154	.154	.00523	191288
	.0016	.00000201	.201	.00683	146455
	.0018	.00000254	.254	.00864	115716
	.0020	.00000314	.314	.01067	93731
	.0022	.00000380	.380	.01291	77464
	.0024	.00000452	.452	.01536	65091
	.0026	.00000531	.531	.01803	55464
	.0028	.00000616	.616	.02091	47822
	.0030	.00000707	.707	.02405	41660
	.0032	.00000804	.804	.02731	36614
	.0034	.00000908	.908	.03084	32404
	.0036	.00001018	1.018	.03457	28929
	.0038	.00001134	1.134	.03851	25967
	.0040	.00001257	1.257	.04268	23433
	.0042	.00001385	1.385	.04704	21250
50	.0044	.00001521	1.52	.05164	19366
49	.0046	.00001662	1.66	.05644	17718
48	.0048	.00001810	1.81	.06145	16273
47	.0050	.00001964	1.96	.06668	14997
46	.0052	.00002124	2.12	.07212	13866
45	.0055	.0000238	2.38	.0807	12394
44	.0058	.0000264	2.64	.0897	11145
43	.0060	.0000283	2.83	.0960	10415
42	.0062	.0000302	3.02	.1025	9753
	.0065	.0000332	3.32	.1127	8824
41	.0066	.0000342	3.42	.1162	8607
40	.0070	.0000385	3.85	.1307	7652
39	.0075	.0000442	4.42	.1500	6665
38	.0080	.0000503	5.03	.1707	5858
37	.0085	.0000567	5.67	.1927	5189
36	.0090	.0000636	6.36	.2160	4629
35	.0095	.0000709	7.09	.2407	4154
	.0100	.0000785	7.85	.2667	3749
34	.0104	.0000849	8.49	.2885	3466
	.0105	.0000866	8.66	.2940	3400
	.0110	.0000950	9.5	.3228	3098
	.0115	.0001040	10.4	.3525	2835
33	.0118	.0001094	10.9	.3714	2693
	.0120	.0001131	11.3	.3841	2604
	.0125	.0001228	12.3	.4168	2400
32	.0128	.0001287	12.9	.4370	2288
	.0130	.0001327	13.3	.4508	2218
31	.0132	.0001369	13.7	.4647	2152
	.0135	.0001433	14.3	.4861	2057
30	.0140	.0001539	15.4	.5228	1913
	.0145	.0001651	16.5	.5607	1783
29	.0150	.0001767	17.7	.6001	1666
	.0155	.0001889	18.9	.6415	1559
	.016	.0002011	20.1	.6828	1465
28	.0162	.0002061	20.6	.7000	1429
	.0165	.0002140	21.4	.7267	1376
	.0170	.0002270	22.7	.7709	1297
27	.0173	.0002351	23.5	.7983	1253
	.0175	.000241	24.1	.8167	1224
	.0180	.000255	25.5	.8642	1157
26	.0181	.000257	25.7	.8738	1144
	.0185	.000269	26.9	.9135	1095
	.0190	.000284	28.4	.9645	1037
	.0195	.000299	29.9	1.014	986.2
	.0200	.000314	31.4	1.067	937.3
25	.0204	.000327	32.7	1.110	900.9
	.0205	.000330	33.0	1.121	892.1
	.0210	.000346	34.6	1.176	850.0
	.0215	.000363	36.3	1.233	811.0
	.0220	.000380	38.0	1.291	774.6
	.0225	.000397	39.7	1.348	741.8
24	.0230	.000415	41.5	1.411	708.7
	.0235	.000433	43.3	1.470	680.3
	.0240	.000452	45.2	1.536	650.9
	.0245	.000471	47.1	1.601	624.9
	.0250	.000491	49.1	1.667	599.9
23	.0258	.000523	52.3	1.775	563.3
	.0260	.000531	53.1	1.8032	554.5
	.0270	.000573	57.3	1.9444	514.3
	.0280	.000616	61.6	2.091	478.2
22	.0286	.000642	64.2	2.182	458.4
	.0290	.000661	66.1	2.245	445.4
	.0300	.000707	70.7	2.400	416.6
	.0310	.000755	75.5	2.564	390.0
21	.0317	.000789	78.9	2.680	373.1
	.0320	.000804	80.4	2.731	366.1
	.033	.000855	85.5	2.906	344.3
	.034	.000908	90.8	3.084	324.3
20	.0348	.000951	95.1	3.23	309.6
	.035	.000962	96.2	3.27	306.1
	.036	.001018	101.8	3.46	289.3
	.037	.001075	107.5	3.65	274.0
	.038	.001134	113.4	3.85	259.7
	.039	.001195	119.5	4.06	246.3
	.040	.001257	125.7	4.27	234.3
19	.041	.001320	132.0	4.48	223.0
	.042	.001385	138.5	4.71	212.5
	.043	.001452	145.2	4.93	202.8
	.044	.001521	152.1	5.16	193.7
	.045	.001590	159.0	5.40	185.2
	.046	.001662	166.2	5.64	177.2
	.047	.001735	173.5	5.89	169.8
18	.0475	.001772	177.2	6.02	166.2
	.048	.001810	181.0	6.15	162.7
	.049	.001886	188.6	6.40	156.2
	.050	.001966	196.6	6.67	149.8
	.051	.002043	204.3	6.94	144.1
	.052	.002124	212.4	7.21	138.7
	.053	.002206	220.6	7.49	133.5
17	.054	.002290	229.0	7.78	128.6
	.055	.002376	237.6	8.07	123.9
	.056	.002463	246.3	8.36	119.6
	.057	.002552	255.2	8.67	115.3
	.058	.002642	264.2	8.97	111.5
	.059	.002734	273.4	9.28	107.8
	.060	.002827	282.7	9.60	104.2
	.061	.002923	292.3	9.93	100.7
	.062	.003019	301.9	10.25	97.53
16	.0625	.003068	306.8	10.42	95.98
	.063	.003117	311.7	10.59	94.4
	.064	.003217	321.7	10.92	91.53
	.065	.003318	331.8	11.27	88.74
	.066	.003421	342.1	11.62	86.07
	.067	.003526	352.6	11.97	83.54
	.068	.003632	363.2	12.33	81.10
	.069	.003739	373.9	12.70	78.74
	.070	.003848	384.8	13.07	76.52
	.071	.003959	395.9	13.44	74.40
15	.072	.004072	407.2	13.83	72.32
	.073	.004185	418.5	14.21	70.37
	.074	.004301	430.1	14.61	68.45
	.075	.004418	441.8	15.00	66.65
	.076	.004537	453.7	15.41	64.89
	.077	.004657	465.7	15.82	63.21
	.078	.004778	477.8	16.23	61.61
	.079	.004902	490.2	16.65	60.06
14	.080	.005027	502.7	17.07	58.58
	.081	.005153	515.3	17.50	57.14
	.082	.005281	528.1	17.93	55.77
	.083	.005411	541.1	18.37	54.42
	.084	.005542	554.2	18.82	53.13
	.085	.005672	567.2	19.27	51.89
	.086	.005809	580.9	19.73	50.68
	.087	.005945	594.5	20.19	49.53
	.088	.006082	608.2	20.65	48.43
	.089	.006221	622.1	21.13	47.33
	.090	.006362	636.2	21.60	46.29
	.091	.006504	650.4	22.09	45.27
13	.0915	.006575	657.5	22.33	44.78
	.092	.006648	664.8	22.58	44.30
	.093	.006793	679.3	23.07	43.36
	.094	.006940	694.0	23.57	42.43
	.095	.007088	708.8	24.07	41.54
	.096	.007238	723.8	24.58	40.68
	.097	.007390	739.0	25.10	39.84
	.098	.007543	754.3	25.62	39.03
	.099	.007700	770.0	26.15	38.24
	.100	.007854	785.4	26.67	37.49
	.101	.008012	801.2	27.21	36.75
	.102	.008171	817.1	27.75	36.04
	.103	.008332	833.2	28.30	35.34
	.104	.008495	849.5	28.85	34.66
	.105	.008659	865.9	29.41	34.00
12	.1055	.008742	874.2	29.69	33.69
	.106	.008825	882.5	29.97	33.37
	.107	.008992	899.2	30.54	32.74
	.108	.009161	916.1	31.11	32.14
	.109	.009331	933.1	31.69	31.56
	.110	.009503	950.3	32.27	30.99
	.111	.009677	967.7	32.86	30.43
	.112	.009852	985.2	33.46	29.89
	.113	.010029	1002.9	34.06	29.36
	.114	.010207	1020.7	34.66	28.85
	.115	.010387	1038.7	35.27	28.35
	.116	.010568	1056.8	35.89	27.86
	.117	.010751	1075.1	36.51	27.39
	.118	.010936	1093.6	37.14	26.93
	.119	.011122	1112.2	37.77	26.48
	.120	.011310	1131.0	38.41	26.04
11	.1205	.011404	1140.4	38.73	25.82
	.121	.011499	1149.9	39.05	25.61
	.122	.011690	1169.0	39.70	25.19
	.123	.011882	1188.2	40.35	24.78
	.124	.012076	1207.6	41.01	24.38
	.125	.012272	1227.2	41.68	24.00
	.126	.012469	1246.9	42.34	23.62
	.127	.012668	1266.8	43.02	23.25
	.128	.012868	1286.8	43.70	22.88
	.129	.013070	1307.0	44.39	22.53
	.130	.013272	1327.2	45.08	22.18
	.131	.013478	1347.8	45.77	21.85
	.132	.013685	1368.5	46.47	21.52
	.133	.013893	1389.3	47.18	21.20
	.134	.014103	1410.3	47.89	20.88
10	.135	.014314	1431.4	48.61	20.57
9	.1483	.017273	1727.3	58.66	17.05
8	.162	.020612	2061.2	70.00	14.29
7	.177	.024606	2460.6	83.56	11.97
6	.192	.028953	2895.3	98.32	10.17
5	.207	.033654	3365.4	114.3	8.75
4	.2253	.039867	3986.7	135.4	7.39
3	.2437	.046645	4664.5	158.4	6.31
2	.2625	.054119	5411.9	183.8	5.44
1	.283	.062902	6290.2	213.6	4.68

Greater Strength for Hose and Tubing

Wire is used in flexible hose and tubing to increase bursting strength and to give mechanical protection against abuse and wear. High-carbon, high-tensile steel of 0.025 to 0.062-in. diameter is usually used. One of the most complex types of hose manufactured is that used in standpipe lines of rotary oil drilling rigs and for ship-to-ship fueling. A 12-strand tape of 0.035-in. wire is often specified for reinforcement.

Another special hose withstands extremely high pressures: surges of 100 to 10,000 psi. It contains a braid of much finer wire having a very high tensile strength. High-pressure steam hose also contains a liner of stainless steel braid to withstand the steam's corrosive effects.

One of the most spectacular examples of the rubber fabricator's ability to develop a new product for a specific need was furnished for combat aircraft. A special hose reinforced with a fine, high-strength wire was substituted in hydraulic lines. This reduced weight sufficiently to allow retention of armor that otherwise would have had to be removed to improve weight distribution for maneuverability.

Flexible, low-pressure hose—such as that used in automobile heaters, vacuum cleaners and air ducts—frequently carried a coiled single-wire reinforcement. The wire, from 0.041 to 0.062-in. diameter, is wound on a mandril to form a helical reinforcement running the length of the hose to prevent collapse of the hose walls from the vacuum inside them.

Rapidly growing use of wire reinforcement is developing in vee-belts and conveyor belts, where wire prevents stretching and dissipates deteriorative heat.

TABLE II—RUBBER ADHESION TESTS FOR 0.037-INCH WIRE

Pad No.	Wire Finish	Pull Required to Loosen Wire (lb.)	Adhesion by Visual Inspection (per cent)
1	Tinned	225	20
	B. P.	228	75
	AP-1	250	100
	AP-1	242	100
2	Tinned	205	5
	B. P.	228	50
	AP-1	249	100
	AP-1	254	100
3	Tinned	183	10
	B. P.	265	60
	AP-1	273	100
	AP-1	263	100
4	Tinned	206	5
	B. P.	215	50
	AP-1	268	90
	AP-1	260	100
5	Tinned	165	5
	B. P.	212	50
	AP-1	268	100
	AP-1	270	100

FIG. 4—To analyze wire coatings and alloys in a spectrophotometer, a sample is dissolved and the solution is tested for light absorption in the metering device. A standard graph helps determine the presence and proportion of individual elements.

Special wires are drawn to sizes as small as 0.002-in. for use in braided coverings on ignition and other electrical cables. Besides increasing strength and abrasion resistance, the covering can serve as an electrical shield. The latest spectrophotometry equipment can analyze minute quantities of metallic coatings or alloy constituents, as shown in Figure 4.

New Automotive Applications

Automotive designers and stylists have constantly presented rubber fabricators with new problems. Heater and defroster improvements led to new rubber ducts incorporating special flattened wire with excellent mechanical adhesion characteristics to provide greater flexibility and longer life. Similarly, fabricators added wire reinforcement to solve problems caused by flexing and vibration, as in truck mud flaps.

Automobiles require door and deck weatherstripping that can follow complex curves. This problem is solved by building a wire with good spring characteristics into the rubber molding. The wire projects at intervals to form loops that are inserted into panel holes, securing the weatherstripping. It also acts as stiffener to form the rubber into the required shape.

New wire applications continue to be made in the oldest of wire's alliances with rubber—tire design. Coiled and chopped wires have been molded into treads for added traction, better heat and static dissipation, and longer life. Tires with breaker strips made up of layers of fine strand are offering added protection against punctures. Bus and truck tires are being manufactured with carcasses composed of several plies of fine wire rope that offer more safety for high-speed, hot-weather operation. Single-ply tires, almost blowout proof, have been developed for trucks. Newer tire designs will depend on wire, too.

More Efficient Purchasing

To Save Time and Money—Management Must Keep Track of Variable Economic Influences

► THE SERVICES performed by natural rubber, synthetic elastomers and plastics have recently been multiplied and diversified to such an extent that there is ample ground for confusion in purchasing. Where it once was possible to set up fixed and convenient boundaries between rubber and other basic materials, it is now almost impossible to make distinctions. Dividing lines between rubber goods and products made of leather, textiles, wood, metals or paper have been blurred by the frequent incursions of high polymers into the "less imaginative" fields.

For example, it is no longer the practice to begin new product development with the basic ingredient limited to one fixed chemical commodity. Today, one can choose between the conventional material and the polymeric material—natural rubber, synthetic elastomer or plastic. The lot of the simple purchase order is not easy—whether it be on the part of the producers or the end-users.

According to Foster D. Snell, Inc., New York, N. Y., consulting engineers: "Evaluation of rubbers and plastics is carried out according to the specifications of ASTM and the various government departments. There is available standard testing equipment which includes such apparatus as the Scott Tensile Tester, durometers, abrasion tester, oxygen bomb, forced draft ovens, ozonizer, weatherometer and Mooney Viscometer."

But what about evaluation when purchasing? Here, enforceable purchase specifications enter the picture: to maintain uniformity of quality. If synthetic rubber is the base of a compound, its technical properties are known. Buyers can acquire the type that fits specifications and deliveries should be uniform. When natural rubber is in the compound, buyers are instructed to acquire the same type and grade used in development stages. But, what if the rubber's technical properties vary substantially from the values expected? The purchaser—perhaps your firm—owns the rubber and it must be used. Modifications and revisions are essential to maintain product quality.

In the purchase of natural rubber, there are no means of determining technical acceptability prior to title passing from seller to buyer. Therefore, use of the RMA Contract for factory buyers is vigorously advocated. This includes specifying deliveries in accordance with RMA type samples and type descriptions, specifying packing in accordance with RMA packing specifications, and adopting standard inspection procedures.

Most of us know that evidence points to greater technical uniformity within a given grade than between grades. Then, why do many companies take deliveries of rubber that actually are of different grades than those called for by purchase orders? Probably because they neglect to compare the tender with the official RMA type sample or they omit checking it for nonpermissible characteristics specified in written type descriptions.

Establishing a rigid inspection policy can result in phenomenal annual savings. Here's how: the simple instance of a No. 1 Ribbed Smoked Sheet being downgraded to a No. 4 Ribbed Smoked Sheet, and not getting a 5c per lb. allowance, can represent an overpayment of $107.52 for every ton purchased. Accordingly, this is an ideal place to reemphasize that American factory consumers who buy rubber under the RMA contract have the right to reject tenders if they are not of contract grade or not packed in accordance with official packing specifications.

Moral: determine which of 30 official RMA grades of natural rubber best serves your purpose, then specify that grade and insist upon it. Work towards improving the quality and packing of shipments. This will not eliminate non-uniform natural rubber—but it should assure better deliveries and lower rubber costs.

Advises S. W. MacKenzie, Dir. of Purchases, U. S. Rubber Co.: "Purchasing agents must stay abreast of conditions. It is of primary importance to understand market differentials. The compounder must watch price fluctuations. The responsibility belongs to purchasing—and an informed technical division. It is the policy of U. S. Rubber to keep its executives posted on market fluctuations with once-per-week bulletins."

In our industry, buyers tend to overlook the spread between grades and discount differentials. Now, when one grade starts "moving out of sight," technical people, if informed of this fact, can make suitable changes so that lower priced grades can be used without affecting final product to any noticeable degree. After all, formulas are the product of the blending of many grades.

A manufacturer needs a sensible inventory policy. In this way, deliveries can be timed to meet production schedules. This also safeguards against tonnage not being around when needed. Purchasing should focus on a five to six months consumption. Remember, there is a costly change in dies to serve specific grades. It is not wise to be found in the "spot market" too often.

Observes Perry Odell, U. S. Rubber: "A rubber dealer always sells something he hasn't got—buys something he doesn't want. In previous years, the Government stockpile and rotation program was a saving factor. Now the purchaser is at the mercy of the market."

Conclusion: There is no easy road to more efficient purchasing. Best advice—keep studying the changing economic map.

EDITORIAL

Items—Questions—Answers

Item: Rubber footwear imports in the first eleven months of 1959 accounted for more than one-third of the U.S. market.

Item: Competition from foreign countries has forced the closing of Gutta Percha & Rubber, Ltd., Toronto, Ont., Canada.

Item: Foreign countries doing business with the U.S. in 1959 added a record total of $3.7 billion to their gold and dollar holdings.

Item: U.S. duty-paid merchandise imports—spurred by heavy dollar volume of highly competitive finished manufactured goods—rose to $9.2 billion in 1959, up nearly 25 per cent from 1958.

Item: The Congressional Record of March 9, 1960, contains the following tabular material:

Rubber Footwear Imports vs. Industry Shipments Since 1953

(Rubber shoes, overshoes, boots and rubber-soled shoes with fabric uppers—in thousands of pairs)

Calendar Year	*Industry Shipments*	*Imports*	*Total Shipments Industry and Imports*	*Per Cent, Imports to Total Shipments*
1953	73,364	688	74,052	0.93
1954	73,835	717	74,552	0.96
1955	81,850	1,086	82,936	1.31
1956	86,190	2,334	88,524	2.64
1957	89,389	6,045	95,434	6.33
1958	92,218	19,474	111,692	17.44
1959[1]	91,945	47,742	139,687	34.18

[1]—11 months

Rubber Footwear Imports by Country of Origin, 11 Mos., 1959

(thousands of pairs)

Country	*Rubber Shoes, Overshoes and Boots*	*Rubber-Soled Shoes with Fabric Uppers*	*Total*
Japan	33,941	9,867	43,808
Hong Kong	473	1,513	1,986
All others (17)	1,108	840	1,948
Total	35,522	12,220	47,742

Employees' Average Hourly Earnings, including Fringe Benefits

	Per Hour
Domestic rubber footwear industry (October 1959)	$2.51
Japanese—all rubber products (March 1959)	.20

Item: The Administration has launched a **promotional program** to boost our export sales abroad, but has "ignored the vexing questions raised by the unprecedented influx of foreign low-cost competitive goods." (Trade Relations Council of the United States).

Item: "It seems obvious that we cannot maintain employment in our industry (footwear) in competition with a country (Japan) paying 20c per hour against more than $2.00 locally." (W. E. Brimer, president, Tyer Rubber Co.).

Ad Infinitum: Study groups, promotional programs, task groups, investigating committees—do-nothingism.

Solution to the Difficulty: Problematical.

But: Does anyone have the feeling lately that too many of our problems are being swept under the rug? Does anyone have the feeling that "promotional programs" are better suited to some activities than to others? Does anyone have the feeling that there are too many study groups, task groups, investigating committees? Does anyone have the feeling that we are waiting for misfortune to overtake us?

Questions: Has "tariff" become a dirty word? Let's debate the proposition! Should we surrender some items of manufacture to others and concentrate on different lines? Let's debate the proposition! Are we exploiting all our resources, all our markets? Let's debate the proposition! Should we give up and return to the soil? Let's debate the proposition.

For heaven's sake, let's do something!

Government Contests Rome-Alcoa Merger

► The U.S. Government has filed to break up the merger of Aluminum Co. of America, Pittsburgh, Penna., and Rome Cable Corp., Rome, N.Y., on charges that the merger violates the Clayton Anti-trust Law by hindering competition in wire and cable production. The complaint seeks a court order to force Alcoa to get rid of all its Rome assets and asks for an injunction to keep the companies from further "intermingling" their operations while the case is pending. The case, filed by the Justice Department in Federal District Court in Syracuse, N. Y. aims to halt the "growing trend of large integrated corporations acquiring successful independents."

Rome and Alcoa were competitors before the merger, the Government contends. Rome produces copper and aluminum wire, and Alcoa, in addition to producing aluminum raw materials, is a maker of end products, including wire and cable, conduit, and cable accessories.

Alcoa Offers Comment

In commenting on the action, Alcoa said it believed the Rome Cable transaction to have been "lawful" and that its position "will be sustained in the courts." The company further stated that at the time of the merger its counsel had carefully examined the proposed affiliation for any anti-trust implication and had advised that the merger was not in violation of the anti-trust laws.

"When Rome Cable became a wholly-owned subsidiary of Alcoa," the company statement continued, "the company noted that Alcoa and Rome would combine their electrical conductor, conduit and accessory activities in order to offer improved service to the rapidly growing electrical industry. It was pointed out at that time that customers would be able to take advantage of both the Alcoa line of aluminum conductor products and the bare and insulated wire and cable products produced by Rome."

Tire Industry Sets Records in 1959

	Sales		Earnings	
	1959	1958	1959	1958
Goodyear	$1,579,257,984	$1,367,575,535	$76,008,956	$65,741,382
Firestone	1,187,784,024	1,061,590,801	64,596,848	53,751,650
U. S. Rubber	976,765,702	870,615,700	35,580,081	22,670,772
Goodrich	771,591,342	697,296,556	37,580,186	35,457,421
General	676,942,133	469,782,099	26,624,080	11,279,117
Dayton	101,838,313	85,509,634	2,414,226	1,324,434
Armstrong	97,420,562	81,317,403	4,972,235	3,227,756
Mansfield*	69,200,000	63,634,395	2,340,000	2,310,588
Seiberling	54,787,924	48,134,084	1,191,019	1,070,089
Lee Rubber	52,164,161	46,558,852	1,521,479	1,797,919
Cooper Tire	37,710,366	31,042,481	1,341,116	956,729
Mohawk	31,656,632	25,513,203	1,219,347	1,065,375

* Estimated

► The tire industry had its biggest year in 1959, in dollar sales, rubber consumed, and tires shipped. Eleven of the 12 major tire companies issuing financial statements made new sales records last year. Seven of the 12 hit all-time highs in profits, and Seiberling set a peacetime earnings record. Only Lee Rubber showed a drop in income. Gains were made in spite of stiffening competition and pressures from the steel strike. Goodyear set new industry records, topping the one and a half billion dollar sales mark, and showing a $76 million profit.

W. R. Grace To Buy Firms

► The board of directors of W. R. Grace & Co., New York, N. Y., has approved the acquisition of Endura Corp., Quakertown, Penna., and Vellumoid Co., Worcester, Mass. The acquisitions are subject to final audit and court license. Endura manufactures tape backings and impregnated papers.

Uscolite Slab Stock

► The Mechanical Goods Division of U. S. Rubber Co., New York, N. Y. has announced several additions to its line of ABS plastic slab stock, marketed under the trade name of Uscolite CP. Installation of special equipment has enabled the division to offer four-inch thick slab for the first time. Also, all 11 thicknesses offered by the company, from ¾ to three inches, are now available in 12- by 12-inch stock slab. Uscolite CP is an acrylonitrile-butadiene-styrene copolymer blend that combines the rigidity and high-heat distortion of plastics with the toughness and low brittle point of rubber.

NCRG Holds Panel on Missile Problems

► "Rubber Problems in the Missile Race" was the topic of a panel discussion held by the Northern California Rubber Group on March 10 at the Elk's Club in Berkeley, Calif. Ross E. Morris (Mare Island Rubber Laboratory) served as moderator of the panel which included James Gaughan (Lockheed) and Eugene Tomlinson (Aerojet - General). Mr. Gaughan spoke on the need of the rubber and missile industries to become better acquainted with each other. He reported that the missile industry, although highly informed in such things as metallurgy, ceramics, electronics, astronautics, nucleonics, reliability, human engineering, and plastics, is basically unaware of rubber as an essential engineering material. Unfortunately, rubber is often considered as a single chemical material of univariable qualities, he said. The missile industry is usually guilty of supplying such an incomplete environmental and usage background to rubber people as to make proper compound selection impossible, Mr. Gaughan claimed. Contrary to public opinion, this stems from language, understanding and technological barriers, and not usually from the classified information barrier, contrary to common belief.

Members of the panel discussion on "Rubber Problems in the Missile Race", which was held on March 10 by the Northern California Rubber Group, and officers of the group. Left to right: Keith Large (Oliver Tire & Rubber), NCRG vice-president; James Gaughan (Lockheed), panelist; Ross E. Morris (Mare Island Rubber Laboratory), panel moderator; Eugene Tomlinson (Aerojet-General), panelist; and Bernard W. Fuller (DuPont), NCRG president.

Liquid Propelled Missiles

In turn, the speaker pointed out, there is much about the missile industry that is not apparent to the rubber industry. Liquid propelled missiles raise a whole new family of fuel compatibility problems lacking a foundation of existing data. In contrast, he stated, solid propelled missiles offer new opportunities to utilize the non-oil resistant polymers. According to Mr. Gaughan, there are two special requirements for rubbers in missile use: five-year storage; and higher reliability during that time. In addition, some peculiarities of supplying the missile industry with rubber were pointed out by the speaker. They are: exceptionally short delivery times, involving small quantities, favoring the small, flexible local supplier; quality and performance of the parts over-ride the usual stringent economics of the rubber industry; production, other than certain prototype, is to military or other defined specifications with formal quality control requirements; and liaison with newly formed missile divisions may involve contact with more people than would be commonly encountered.

The second panelist, Mr. Tomlinson, discussed the use of rubber with liquid rocket engines. He stressed that obtaining elastomeric seals for use with fuels and oxidizers is one of the greatest problems at hand. In describing the development of storable liquid rocket propellants by Aerojet - General, Mr. Tomlinson pointed out the many difficulties associated with the proposed fuel, a 50:50 blend of UDMH:N_2H_4 called Aerozine 50, and with the oxidizer, N_2O_4. The speaker reported that with Aerozine 50, neoprene and butyl appear to be suitable as seals if properly compounded. Nitrile rubber exhibits post-immersion shrinkage, and silicones become soft in four-hour immersion and stiffen in the air after immersion. Viton, Fluorel, and Kel-F elastomers are chemically attacked and decompose. Mr. Tomlinson stressed that aging properties of elastomers are important, since long term storage of the system is involved.

He informed the group that the oxidizer presents even greater elastomer problems. The N_2O_4 is more destructive than red fuming nitric acid. For example, standard Kel-F 5500 compounds decompose within four hours. All the non-fluorinated polymers, with the exception of butyl and Hydropol, have shown no resistance to N_2O_4. Of the fluorinated polymers, only Viton and Fluorel show promise, he stated, and these by special compounding.

Mr. Morris, the moderator, described some of his research and development work in missiles. He told the group that the Polaris, a submarine missile, must be stored in a vertical tube within the submarine. An item called an adapter or "shoe" was designed to support this missile and to isolate it from damaging shock waves. At the time of actual firing, the adapter is required to slide off the tube with the missile and have enough buoyancy to float away from it after ejection. Mr. Morris explained that the problem of shock mitigation was solved through the use of reclaimed butyl, an elastomer of very low resistance. A Teflon surface chemically attached to the rubber article, provided the low coefficient of friction to satisfy the necessity for sliding, and buoyancy was attained by proper engineering design, he said. A question and answer session followed the talks by the panel.

CRG Offers Course

► A course on Rubber Technology, sponsored by the Chicago Rubber Group, will begin in September 1960 at the John Marshall Law School, Chicago, Ill. The course, which has been offered by the group for nine years, consists of 24 lectures, a field trip, and a final examination. Five of the lectures are given by the course coordinator, and the remainder by 19 experts in the field of rubber technology. Additional information can be obtained from John C. Gallagher, Chicago - Allis Manufacturing Co., 113 North Green Street, Chicago 7, Ill.

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1.25 parts staining stabilizer

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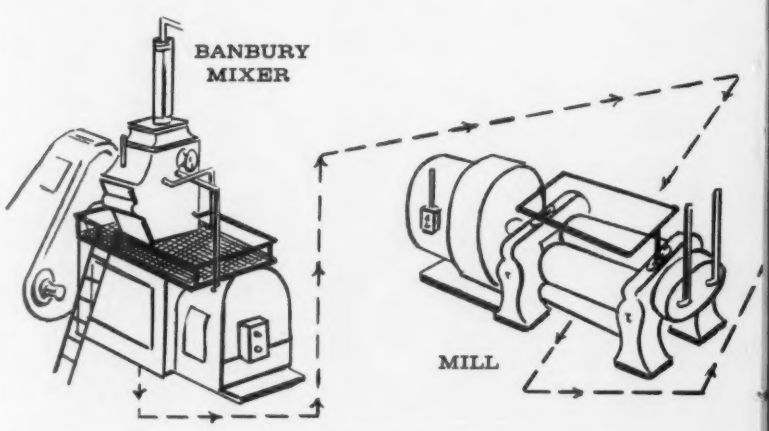
100 parts base polymer (COPO 1712 type)
60 parts ISAF black
37.5 parts highly aromatic extending oil
1.25 parts staining stabilizer

3757—
100 parts base polymer (COPO 1712 type)
75 parts HAF black
37.5 parts highly aromatic extending oil
12.5 parts highly aromatic processing oil
1.25 parts staining stabilizer

3758—
100 parts base polymer (COPO 1712 type)
75 parts ISAF black
37.5 parts highly aromatic extending oil
12.5 parts highly aromatic processing oil
1.25 parts staining stabilizer

3762—
100 parts polymer (COPO 1500 type)
40 parts SAF black
5 parts highly aromatic processing oil
1.25 parts staining stabilizer

3763
100 parts base polymer (COPO 1712 type)
55 parts SAF black
37.5 parts highly aromatic extending oil
7.5 parts highly aromatic processing oil
1.25 parts staining stabilizer



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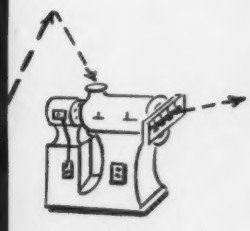

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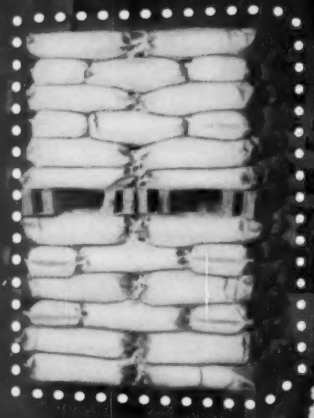

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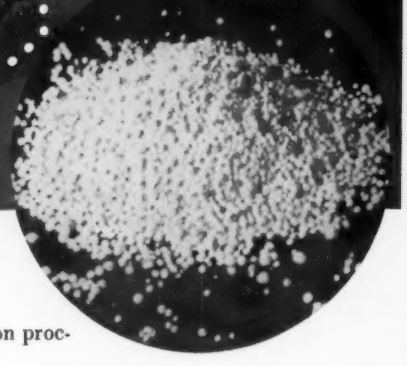

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R.I. Club Hears Carbon Black Panel

► "Carbon Blacks" was the subject of a panel discussion held by the Rhode Island Rubber Club on April 7 at the Pawtucket Golf Club, Pawtucket, R. I. Four papers were presented at the panel discussion, they were: "Physical Properties of Cannel and Thermal Blacks," by Alden B. Davis (Columbian Carbon); "The Properties of Furnace Blacks and the Rubber Stocks Which Contain Them," by Merton L. Studebaker (Phillips Chemical); "Why, Where and How To Use Carbon Blacks," by Dr. Isaac Drogin (United Carbon); and "Future Trends in the Carbon Black Industry," by Dr. Walter R. Smith (Godfrey L. Cabot).

Mr. Davis stated channel blacks fall within the reinforcing grade of carbons and they find application in all phases of the rubber industry. He pointed out that there are other carbons made by the so-called modern furnace process that have about the same approximate particle size as channel blacks, 25 millimicrons. Mr. Davis explained that there are three main properties that vary between these two types of carbons, pH, volatile and structure.

Discusses Two Grades

In his remarks about thermal blacks, Mr. Davis said that there are two grades of thermal blacks that are commonly of interest to the rubber industry: medium thermal black and fine thermal black. He pointed out that these are very coarse carbons by comparison to the channel blacks and also when compared to even the SRF class of carbons. The fine thermal black is about 150 to 160 millimicrons in diameter, and the medium thermal black has a particle size of 300 millimicrons or greater. Thermal blacks are used widely in combination with other carbons to produce lower cost stocks, he stated.

The term "carbon black," remarked Mr. Studebaker, refers to a group of highly carbonaceous, finely divided solid materials which are produced by pyrolyzing or burning hydrocarbon fuels with a deficiency of air. The condition under which they are formed and the treatment which they receive after formation determine their properties, he stated.

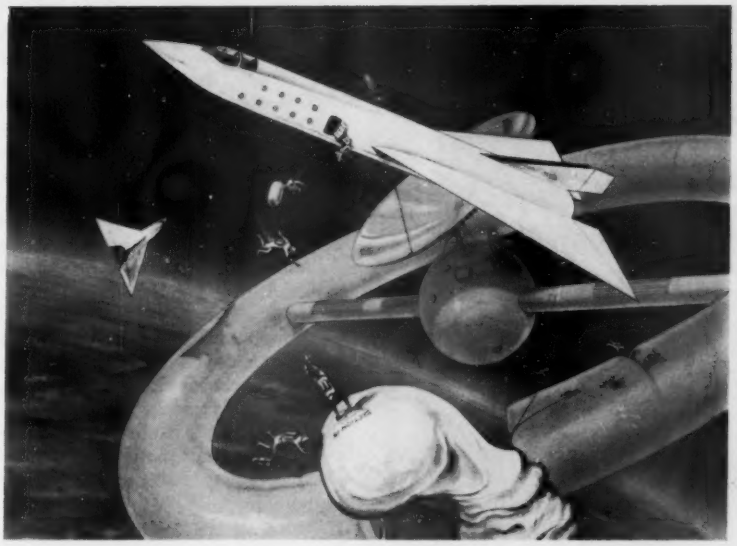
Mr. Studebaker then discussed how a few of the physical properties of rubber are altered by the carbon black which it contains. He included in this discussion the action of carbon blacks on unvulcanized rubber; cross-linking during vulcanization; tensile properties; and compression set.

According to Dr. Drogin, no compounding ingredient has yet been produced that is as efficient and low priced as carbon black. In addition, carbon black is invariably used in products that have to be tough, abrasion resistant, and flex resistant.

Dr. Drogin emphasized that carbon black is a most important compounding ingredient, and from a volume usage standpoint is second only to the polymer hydrocarbon. The carbon black industry is keeping pace with developments in the rubber industry and is providing high quality carbon blacks essential in newly-developed rubber, he informed the group.

Dr. Smith remarked that the decline in the production and consumption of gas blacks of the channel type has been evident since 1950. In addition, a similar decline in gas furnace blacks (SRF) also appears imminent in the very near future. He pointed out that while this decline may be attributed in some degree to economical factors, quality, as reflected in properties of oil furnace blacks, has perhaps been equally responsible.

According to Dr. Smith, a further decline of gas can be anticipated due to the introduction of a new family of oil furnace blacks which provide equivalent, and in some instances, superior properties. Future industry trends, he pointed out, also indicate an increased use of carbon black-rubber masterbatch. It is predicted that within the next three or four years up to 30 per cent of all butadiene-styrene polymer will be used in this form, he stated.



A doughnut-shaped space station envisioned by Goodyear scientists, is shown in the final stages of completion. In the construction of the manned orbiting space craft, individual cells have been lifted into orbit in compact packages and inflated into shape.

Goodyear Designs Space Fabrics

► The first space station designed for human habitation may be packed in a small container as it leaves the earth, blown into shape like a balloon when it reaches orbit, and "rigidized" by quick-setting plastic foam, according to engineers of the Goodyear Aircraft Corp., Akron, Ohio. Expandable coated fabric structures will be folded into compact packages, boosted into orbit by ferry rockets, expanded by internal pressure and joined to other sections to erect the complete station. Although air or gas pressure will provide structural stiffness, says S. J. Pipitone, manager of the Aeromechanics Technology Division, the facility can be made more rigid by shooting foamed-in-place plastic in areas between outer and inner walls, giving added permanence.

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Seiberling Modernizing

► A $2 million modernization program, largest in the history of the company, has been announced by Seiberling Rubber Co., Akron, Ohio. The $2 million program, to be concentrated on the Barberton tire plant, brings to a total of nearly $3.5 million the cost of the company's current expansion and improvement program. In January the company announced its plans for a $1.3 million rubber goods plant in Arkansas. In addition to the Barberton improvements, new equipment and major revisions of some department operations are planned, according to E. A. Hensal, vice-president in charge of production, who explained that the improvement program ties in with a current push for more tire volume.

The main improvements at the Barberton plant will be in the Truck Tire Building Department, the Passenger Tire Curing Department, and the Final Finish Department. New types of semi-automatic tire building machinery will be in regular production operation before the end of the year, and new automatic tire curing presses are slated for installation, Mr. Hensal said. An $8 million expansion, not included in the new modernization figure, is under way at Copolymer Rubber and Chemical Corp., Baton Rouge, La., synthetic rubber producer partly owned by Seiberling.

U.S. Rubber Names Eckert

► Dr. Charles F. Eckert has been appointed manager of elastomer research at the Wayne, N. J., research center of U. S. Rubber Co. He succeeds Dr. Marvin C. Brooks, who has joined the firm's Tire Division in Detroit, Mich. In his new position, Dr. Eckert will be responsible for directing fundamental research on new types of rubber and applied research on both existing and new types of rubber. A graduate of Baker University, where he received his A.B. degree in 1938, Dr. Eckert received his Ph.D. degree from Northwestern University in 1942. That same year he joined U. S. Rubber in its Research and Development Department. Dr. Eckert has worked on applications of the electron microscope to latex and rubber filler problems, synthetic fiber research, latex foam technology and the development of Vibrafoam polyurethane foam products. He is a member of the American Chemical Society.

Rubberized Subway Track

► The New York City Transit Authority is experimenting with a new tieless, spikeless subway track utilizing a 160-foot strip of concrete, rubber and rail. The new type of track is expected to produce a smoother and more comfortable ride, and to lessen the effects of erosion and moisture. The roadbed consists of two parallel strips of concrete, 21 inches high and nine inches wide, into which are set flat-bottomed steel troughs cushioned by rubber an inch thick. Inside the troughs, spaced thirty inches apart, are rubber tie plates, each a foot long. The plates are fitted with flaps that encase the rail bottom. The rails are held firmly in place by lug bolts that are anchored in the concrete and run up through the steel trough and rubber pads. The third, or power rail is also mounted on concrete. Between the rail and the concrete is a thick cushion of felt that serves as an insulator. The present subway system employs thick wooden ties which tend to rot, resulting in jagged track and bumpy riding. The use of the concrete slabs will facilitate drainage. Authority officials believe the improved roadbed will last longer and will be cheaper to maintain. If the experimental strip in the Grand Central-Times Square shuttle proves effective, similar track will be used in other places in the city.

Auto Leasing Increases

► A. J. Schoen, president of Wheels, Inc., Chicago, Ill., an auto fleet leasing firm, has disclosed that the rubber industry leased approximately 3,500 automobiles in 1959 in fleets for its sales representatives, a gain of 15 per cent. This was the greatest number of autos ever leased by the industry and it is predicted that 1960 will show another 15 per cent jump. Mr. Schoen said that leased autos now comprise 26 per cent of the cars used in the industry and are worth $7.5 million. Another 24 per cent are company-owned and 50 per cent are owned individually by sales representatives.

Major reasons for the growing use of leased auto fleets, according to Mr. Schoen, are: (1) company-owned fleets tie up too much working capital, which companies can use more profitably in modernizing plant and expanding sales, and (2) mileage payments to sales representatives are tending to increase more rapidly than actual costs, making leasing more economical than using cars owned by sales representatives.

Heka Selling Protector

► Protector, an agent for preventing light cracks and aging is now being distributed by Heka Imports and Exports, Inc., New York, N. Y. According to the company, Protector blooms out slightly on the surface of the rubber mixture forming a thin homogeneous protecting layer on the finished rubber product. Because of its plasticity, this layer constitutes a supple non-breakable coat. The protective layer is said to regenerate itself automatically from the interior so that the protection provided by the application of this material has a lasting effect.

Protector is said to reduce formation of corona; form an effective safeguard against oxidation of rubber; and resist the effects of ultra-violet light. Supplied in slabs weighing 4-5 kilos, the material has a specific gravity of 0.91; a melting point of 52° to 54°C; acid number, ester number, soponification value and ash of 0. At 20°C, it is soluble in benzole and insoluble in water, acetone, dichlorethane, and petroleum ether. Some applications for protector are in bicycle and automobile tubes and tires; section rubber in the automobile industry; cables; and technical rubber goods.

U.S. Rubber Names Two

► Dr. Clide I. Carr and Dr. Charles P. Roe have been appointed senior research scientists at the Research Center of the U.S. Rubber Co., Wayne, N. J. Dr. Carr, in the Radiation Research and Fiber Departments, is doing research on the preparation and evaluation of new fibers, while Dr. Roe, a member of the Latex and Plastics Department of the Research Center, is conducting studies in the production of synthetic polymer dispersions.

Dr. Carr, with the company since 1949, has worked on polyvinyl chloride resin research for many years. He is a graduate of the University of Montana and holds a Ph.D. in physical chemistry from the University of California. Dr. Roe, with the company since 1934, worked on natural rubber latex until the growth of synthetic rubber during World War II, engaging in synthetic rubber research since that time. He is the co-author of several articles on the stability of dispersions and the growth of latex particles in synthetic dispersions. A graduate of the University of Minnesota, he holds a Ph.D. in physical chemistry.

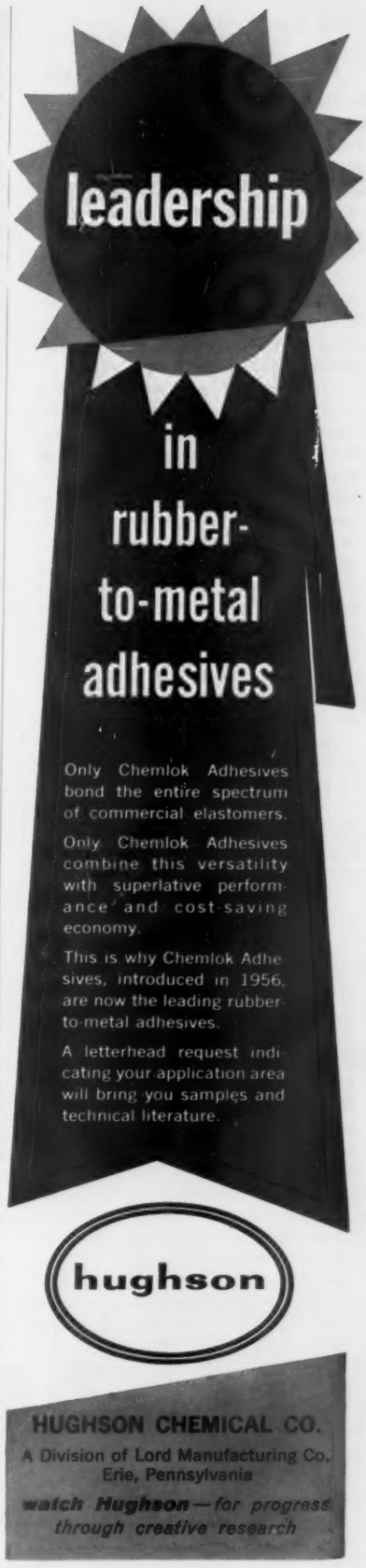
Texas Butadiene to Merge

► A proposal for the merger of Industrial Rayon Corp. and Texas Butadiene & Chemical Corp. was to have been voted on by shareholders of both companies at special meetings on April 29, with Industrial Rayon to be the surviving corporation. A two-thirds vote of the outstanding stock of each company is required for approval. Under the terms of the merger, all of the common and preferred stock of Texas Butadiene & Chemical will be converted into 1,687,298 shares of Industrial Rayon, raising the number of shares of common outstanding to 3,538,553. Industrial Rayon has 1,851,255 shares of common outstanding at present.

Texas Butadiene & Chemical produces aviation gasoline, butadiene and other petrochemical products at its plant in Channelview, Texas, and an expansion program for butadiene will be completed this year, raising the plant's annual capacity from 90,000 tons to about 120,000 tons. The company has a 30 per cent interest in a synthetic rubber plant under construction near Marseilles, France, and is negotiating with the Argentine government for construction of synthetic rubber and butadiene facilities in that country. Principal products of Industrial Rayon include Tyrex tire cord, rayon textile yarns, rayon and rayon blend knit fabrics, polypropylene fibers, and nylon staple and bulk filament yarns.

Garlock Acquires Chetron

► Following its annual stockholders' meeting on April 6, Garlock Packing Co., Palmyra, N. Y. announced that: it has contracted for the acquisition of Chetron Corp., Los Angeles, Calif., as a wholly owned subsidiary; changed its corporate name to Garlock, Inc., and elected as director Donald A. Gaudion, president of Pfaudler Permutit, Inc. The stockholders also approved proposals that the authorized capital stock of the corporation be increased from one million to two-and-one-half million shares of the par value of $1.00 per share and that the statement of corporate purposes be changed to permit further diversification. Under the purchase agreement, the capital stock of Chetron Corp. was to have been exchanged for an undisclosed amount of Garlock stock on April 29 provided the transaction is approved by the California Commissioner of Corporations, as required by California law.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Cabot Introduces Regal Carbon Blacks

► Owen J. Brown, Jr., vice-president and director of sales for Godfrey L. Cabot, Inc., Boston, Mass., has announced world-wide production of an entirely new and different family of carbon blacks, offering properties which are said to have been never before available. Developed by Cabot's Research and Development Department, the blacks are said to represent the beginning of a whole range of new type oil furnace blacks now being developed by Cabot.

Trademarked name of this family of three new blacks is Regal. Individually, they are called Regal 300, Regal 600, and Regal SRF. Even though the Regal SRF can be classified as a semi-reinforcing furnace black, Regal 300 and Regal 600 are so new and different that they cannot be listed under any existing classifications, the company points out. Mr. Brown states that this new development in the carbon black industry has been brought about by a brand-new method of manufacture of carbon black from oil. "Now, for the first time, this new family of Cabot blacks makes it possible to duplicate the performance characteristics of gas-SRF and premium-priced channel blacks, and to provide blacks with properties never before available from either gas or oil-produced furnace blacks."

Lower Modulus

Unlike HAF, ISAF and SAF types of oil furnace black, Cabot reports that Regal blacks are lower in structure, exhibit lower modulus, lower hardness and higher elongation. "In fact," says Mr. Brown, "in our new Regal process, the modulus can be lowered hundreds of pounds, but we have purposely chosen the levels to match gas-SRF black as well as EPC black, and to provide the best compromise among tread wear, economy, dispersion and other properties." To support these conclusions, Mr. Brown points out that "Regal blacks have been road tested and proved in more than 3,000,000 tire miles of Cabot road tests."

The economic significance of this development to the rubber industry here and abroad is explained by Mr. Brown in this way: "Since Regal blacks are available world-wide from Cabot plants, they can be purchased in local currencies. The fact that the initial family includes oil black replacements for both gas-SRF and channel blacks means that overseas, the rubber industry need no longer import gas-SRF and channel blacks in exchange for American dollars. The advantages of ready availability and convenience in ordering blacks made in your own or a nearby country are obvious, and include assurance of greater relative price stability—both here and abroad—of oil-made blacks as compared with blacks made from natural gas."

Mr. Brown points out that this Regal development is another major step in the announced Cabot long-range program to meet threatened gas shortages and rising natural gas prices by assuring an uninterrupted supply of carbon blacks for all purposes, world-wide, from raw materials not subject to the economic pressures affecting natural gas and at locations where there is no natural gas.

Cabot has three bulletins available describing the properties and performance of each of its three new blacks, but briefly, here are some of the highlights. The black Cabot called Regal 300 is described as an excellent channel replacement oil black, combining virtually identical channel black properties for the faster curing rate of HAF types. It is stated that Regal 300 has actually outperformed channel blacks in wear and tear resistance, cracking and chipping, in passenger car tire and truck tire road tests. Priced the same as HAF, it is being recommended for highway, off-the-road truck and passenger car tire treads, and tread rubber, where service requires typical channel black resistance to tearing, cutting and chipping. There are similar service requirements in the mechanical goods field, as in conveyor belting covers, tank tread blocks, heavy duty hose cover and cable jacket compounds.

Cabot's Regal 600 is said to provide a striking combination of low hardness—high tread wear resistance properties never before provided by a carbon black, offering interesting product improvement possibilities, not available from either gas-produced or other type oil furnace blacks. It reportedly combines quieter ride and better traction properties with the excellent tread wear resistance of an ISAF black. Priced the same as ISAF black, Cabot reports it has outperformed ISAF black in cold butadiene-styrene, oil-extended butadiene-styrene and natural rubber, by giving higher tensile strength and elongation, lower modulus and hardness, lower heat generation and superior cut growth resistance.

The black Cabot called Regal SRF is the carbon black industry's first oil furnace SRF black. Cabot reports that it matches and in some cases excels, the performance characteristics of gas-produced, semi-reinforcing furnace carbon blacks. Priced the same as gas-SRF, the Regal SRF is claimed to be interchangeable with gas-SRF, giving physical properties and processing characteristics equal to gas-produced SRF blacks. Bulletins, samples and further technical information are available from the Sales Department, Godfrey L. Cabot, Inc., 125 High Street, Boston 10, Mass.

Quelcor Installs Dip Tank

► A dip tank said to be the world's largest tank for polyvinyl chloride dip coating of metal products has been installed by Quelcor, Inc., Chester, Penna. The tank is designed to handle single pieces up to six-and-a-half feet in diameter and 20 feet long. By controlling preheat temperature of the part and time cycles, single layer coatings of from 1/32 to 1/4-inch can be applied. On light gauge metals, layers can be built up to virtually any thickness desired. Operating in conjunction with batch or continuous preheating and curing ovens this installation can handle many different large size pieces or a large quantity of smaller similar parts on a continuous production basis.

Elastomer Course Slated

► A one-week intensive course, The Chemistry and Physics of Elastomers, will be given June 13 to 17 at the University of Akron, Akron, Ohio. The course will be limited to 25 scientists and engineers employed in industry and business. On the staff for the course are: Dr. Maurice Morton, professor of polymer chemistry and director of the Institute of Rubber Research, University of Akron; Dr. Fred J. Bueche, professor of polymer physics, Institute of Rubber Research, University of Akron; Dr. Kenneth W. Scott, section head, Goodyear Tire and Rubber Co., Akron, Ohio; and Howard L. Stephens, instructor in Rubber Chemistry (laboratory), University of Akron.

Research in Europe

► A $120,000 expanded program of basic research in Europe, providing for additional financial support to universities and increased contact with European scientific and engineering research activities, has been announced by the U. S. Rubber Co., New York, N. Y. Seven universities in six countries are already receiving grants through the program. In charge of the new program is Dr. Philip D. Brass, research associate of the Research Center, Wayne, N. J., who is now located in Paris, France. Dr. Brass will keep the research organization informed on scientific and engineering developments in Europe, cooperating with professors and students in the universities where the company supports research. Within the company, he will promote the exchange of information between the U. S. Rubber research organization in the United States, and personnel doing research in Europe. Dr. Brass was named a research associate with three other scientists when this position was created last August.

Universities now participating in the European research program are: Glasgow University in Scotland; Imperial College of Science and Technology, University of London, England; University of North Staffordshire, England; University of Utrecht, the Netherlands; University of Liege, Belgium; University of Strasbourg, France; and Technische Hochscule in Aachen, West Germany.

New Employment Trend

► A gain of 20 per cent in the demand for rubber and plastics engineers and executives has taken place during the past four months, according to a recent survey of employment conditions undertaken by Cadillac Associates, Inc., Chicago, Ill. Demand was 30 per cent higher than that of the previous quarter for research and development men with the ability to develop processes for new products. There has been a 25 per cent increase in demand for plant lay-out men for equipment design, installation and maintenance. A marked increase in interest has also been shown in technical men, with a 15 per cent rise in the demand for applied engineering men. The Cadillac survey shows a drop of 12 to 15 per cent in the demand for sales representatives in the $10,000 to $12,000 category.

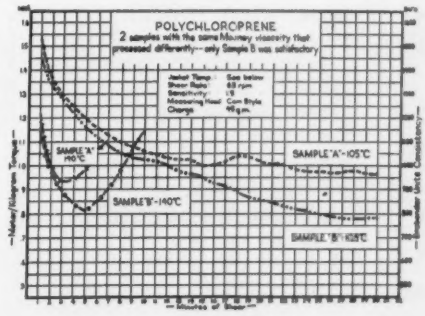
U.S. Rubber Slotted Tire

► A circumferentially-slotted truck tire, utilizing principles of passenger-tire design to give improved traction, stability and tread wear, has been introduced by the U.S. Rubber Co., New York, N. Y. The slotted tire has an eleven row tread instead of the conventional five row truck tire tread. While slotting the tire continuously around its circumference is the practice in passenger tires, this is the first time the principle has been successfully incorporated in a heavy service tire, U. S. Rubber states. The company claims up to 25 per cent greater mileage for the tire, the U. S. Royal Fleet Carrier, which is designed to give full pulling and stopping power as well as increased protection against sideskidding and jackknifing. The tire is made with rayon and nylon tire cord in tubed and tubeless types. Both types have rayon or nylon shock pads respectively between the tire body and tread rubber, and the rayon tires are also available with a steel shield. Polyisoprene rubber is used to fortify the natural rubber and reduce heat build-up in the larger sizes.

Buys U.S. Butadiene Unit

► Rohm & Haas Co., Philadelphia, Penna., has purchased from the United States government for $6,-110,000, its idle butadiene plant in Lexington, Ky. Dr. F. O. Haas, president of the company, reports that the firm plans to use the 139-acre site as a location for a new plant to manufacture products already made by the company. Dr. Haas pointed out that the company does not make butadiene and has no plans for going into the rubber business. Rohm & Haas produces a line of plastics and other synthetic resins, as well as textile, leather and agricultural chemicals.

According to the General Services Administration, six sealed bids were received for the former synthetic rubber manufacturing plant. Rohm & Haas' bid of $6.1 million topped such bidders as Shell Oil Co., who bid $5.3 million, and Union Carbide Corp., who bid $5.1 million, GSA states. The plant has been idle since 1953, and when operating could produce 87,000 tons of butadiene a year. The plant cost the government $30 million to build.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Fort Wayne Hears DeCrease on Bonding

► The fourth meeting of the 1959-1960 season of the Fort Wayne Rubber & Plastics Group was held on April 14 at the Van Orman Hotel in Fort Wayne, Ind. The technical program consisted of a talk on "Compounding Elastomers for Rubber-to-Metal Adhesion," by William M. DeCrease (Hughson Chemical). He stated that the introduction of organic adhesives for bonding elastomers to metal resulted in greater freedom for the rubber compounder in a choice of compounding ingredients. Brass plating, he explained, placed some very definite restrictions on the compounder such as the type and amount of sulfur and sulfur-containing vulcanizing agents in order to achieve a proper chemical union between the copper in the brass and the sulfur in the elastomer compound.

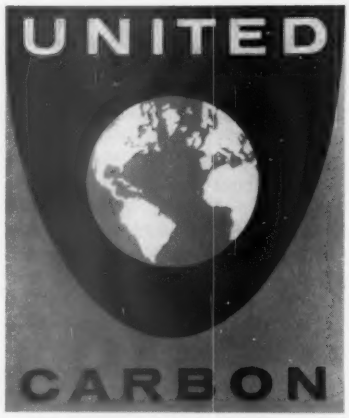
According to Mr. DeCrease, some of the major considerations which should be helpful when compounding an elastomer which is to be bonded to metal are: elastomers may be indexed according to the ease with which they are bonded to metal; in copolymer elastomers, the concentration of monomers has a pronounced effect on the adhesion to metal; when bonding blends of elastomers, an adhesive which satisfactorily bonds either elastomer when used alone should be used; and in general, ester type or highly aromatic plasticizers are more harmful to adhesion than are naphthenic or parafinic.

Continental Black Plant

► Continental Carbon Co. has announced that it will build the first carbon black plant on the West Coast, a more than $2.5 million project, at Bakersfield, Calif. Construction of this plant will enable Witco Chemical Co., Inc., sole distributor of Continental Carbon products, to do increased business in carbon black on the West Coast. The new plant, an oil furnace plant, will have an annual capacity of 30 million pounds of carbon black. Continental Carbon Co., a major carbon black producer, operates four plants in the United States and is constructing three carbon black plants in Europe in joint ventures. The company has also announced that it will move its headquarters from Amarillo to Houston, Texas, starting the relocation in June.

United Carbon Trademark

► To better identify the company and its activities, the United Carbon Co., New York, N. Y., has adopted a new trademark, shown herewith. In explaining the reasons for the new trademark, R. W. French, president, explained that a hallmark or trademark is increasingly helpful as a focal point in better identifying a firm. Such a symbol, he said, is particularly important when the products and markets are spreading to other places and countries and are changing through diversification. The new symbol was developed in order to establish and identify permanently a broader, deeper understanding of United Carbon both in this country and abroad.



Armstrong Acquiring Firm

► Armstrong Rubber Company has called a special meeting of stockholders, scheduled for May 16, to vote on a proposal to acquire full ownership of the company's affiliate Armstrong Tire and Rubber Co., Natchez, Miss. Armstrong Rubber proposes to exchange 150,000 shares of new common stock for the 50 per cent interest in the affiliate held by Sears, Roebuck & Co. The company also intends to build a tire manufacturing plant on the West Coast, financed by a $25 million twenty-year loan. A tentative agreement for the loan has already been made, the company reports. At the meeting, stockholders will be asked to approve conversion of the present Class A nonvoting and Class B voting stock into a single class of voting common. Armstrong Rubber has already applied for listing of the proposed new common stock on the New York Stock Exchange.

Spencer Addresses Ontario Group

► L. E. Spencer, president of Goodyear Tire and Rubber Co. of Canada, Ltd., was the featured speaker at the Ontario Rubber Group dinner meeting on April 8, which was held in conjunction with the annual conference of the Division of Rubber Chemistry, Chemical Institute of Canada, at the Walper Hotel in Kitchener, Ontario, Canada. The subject of Mr. Spencer's remarks was "Rubber — 60's — Very Promising," and he informed the 185 delegates in attendance that statistical research has proven that one of the best barometers of standards of living throughout the world is the consumption of rubber per capita within the different countries of the world. He explained that the per capita consumption of new rubber (natural and all types of synthetic) varies from about 20 pounds in North America to about six pounds in Europe to only a few ounces in Asia and Africa.

The Goodyear president also touched upon the automotive vehicles area in respect to the outlook for the rubber industry. He said here the promise for the industry is even brighter than the general prediction. According to Mr. Spencer, we can expect a 25 per cent, or 1,300,000, vehicle increase within the next five years and a 50 per cent, or 2,600,000, vehicle increase during the decade of the 60's.

Resin Plant Completed

► National Polychemicals, Inc., Wilmington, Mass., has completed the construction of a plant in Conway, N. C., for the production of synthetic resins. Initially, the plant will produce phenol and urea formaldehyde resins for the woodworking, paper, and textile industries, as well as other industrial outlets in the South. The unit will be under the direction of L. F. Bornstein, vice-president in charge of the firm's Synthetic Resin Division, while Frank B. Spires, will serve as manager of the operation. Mr. Spires, who received his education at the University of South Carolina, was formerly plant manager of Stilley Plywood Co., Inc., Conway, N. C. National Polychemicals is also expanding its Wilmington, Mass., facilities to take care of needed increased production of resins in New England.

Depew Awarded Patent

► U. S. Patent No. 2,933,469, issued April 19, 1960 to Harlan A. Depew, manager, Research Department, American Zinc, Lead and Smelting Co., Kirkwood, Mo., covers an improvement in the process for making aqueous rubbery dispersions. It consists of adding an aqueous emulsion to a latex containing a rubber selected from the group consisting of a natural rubber and synthetic rubbery polymers of conjugated dienes. The emulsion is prepared by dispersing vulcanizing ingredients in a liquid hydrocarbon with a boiling point in the range of 25° to 300° C. and adding water to the dispersion. The title of the invention is "Process for preparing stable mixed dispersions of elastomers with volatile water — immisible organic liquids containing destabilizing components and products therefrom."

The dispersion can be used as an adhesive that cures when it is broken on application. As a magnesia dispersion it is of interest for use in forming a stable Neoprene. Another application would be as a stable zinc oxide natural rubber dispersion. Basically, the process consists of dispersing curatives for elastomers in a volatile liquid such as kerosene.

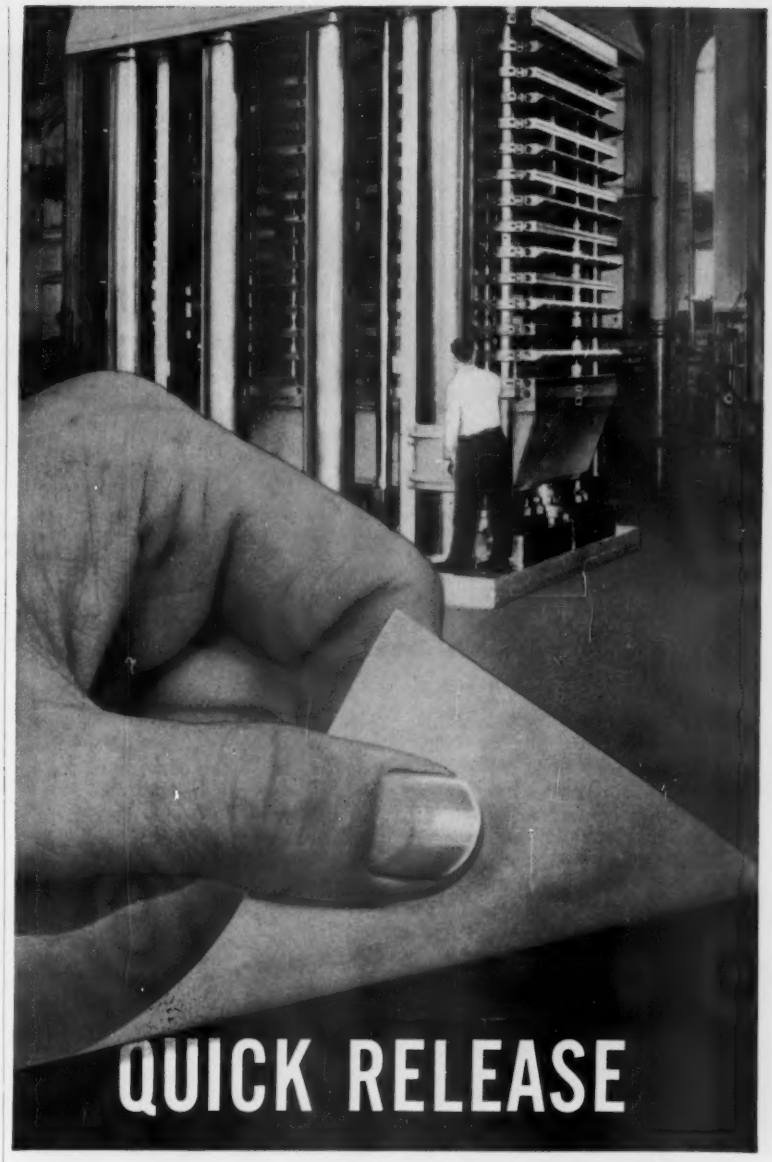
This kerosene paste is then dispersed in water to form an emulsion, which is then mixed with an elastomer latex. The mixed dispersion includes kerosene droplets containing the curatives and elastomer particles, separately in Brownian motion. There can be no contact of the curatives and the elastomers and so the mixed dispersion is stable.

Arlee Ups Output

► Arlee Foam Rubber Products, Inc., Gardena, Calif., has added 15,000 square feet of space to be devoted to increased production of flexible polyurethane foam, and the addition of rigid polyurethane foam facilities. The rigid products will satisfy demands for insulation, flotation, packaging and such diverse applications as missile nose cones.

RubberCrafters Formed

► MacEwan & Smith, Inc., Doylestown, Penna., has become RubberCrafters Inc., with William A. Roth, Jr., general manager of MacEwan & Smith for the past six years, in the position of president of the company. RubberCrafters has assumed the commitments of the former company.



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Officers flanking the speaker at the luncheon session during the annual conference of the Chemical Institute of Canada Rubber Division include (left to right): H. A. Hencher, C. M. Croakman, A. Jaychuk, Mayor Wambold of Kitchener who addressed the group, J. L. Macdonald, W. Cline, O. R. Huggenberger, D. W. Hay, R. R. Tartaglia and D. G. Seymour.

C.I.C. Rubber Division Meets

► Elastomer test techniques and the properties and uses of "New Polymers" were discussed before a record audience at the April 8 meeting of the Rubber Chemistry Division of the Chemical Institute of Canada. At Walper House, Kitchener, Ont., nearly 200 persons attending the Division's annual conference heard papers on silicone rubber, polyurethanes, polyisoprenes, polybutadienes and other novel materials at the morning session chaired by Russell R. Tartaglia (Goodrich Canada); followed by talks on rheological, carbon black dispersion, antiozonant and micro rubber test procedures at the afternoon session which was chaired by O. R. Huggenberger (Dominion Rubber).

John L. Macdonald (DuPont), chairman of the C.I.C. Rubber Division, presided over a short business meeting which opened the session. Following a budget report by David W. Hay (Polymer Corp.), nominations for 1960-61 officers were submitted by a committee comprising three past chairmen: J. A. Carr (Dunlop), H. K. Cunliffe (Dominion Rubber) and O. R. Huggenberger. Nominated and elected for the coming year were: *Chairman,* Alex Jaychuk (Goodyear); *Vice-Chairman,* David W. Hay; *Secretary-Treasurer,* Carl H. Croakman (Columbian Carbon of Canada); *Directors,* Wray Cline (Canadian Gen. Tower); W. J. Nichol (Dunlop Canada), and A. H. Holden (Canada Chemical & Colours). The business meeting concluded with passage of a resolution establishing an educational committee to coordinate projects of the C.I.C. Rubber Division, the Ontario Rubber Group and the Quebec Rubber and Plastics Group.

The luncheon featured an address by Mayor Wambold of Kitchener, who extended civic greetings to the conferees and stressed benefits that have accrued to the city because of its association with the rubber industry. The mayor pointed out that many working people in Kitchener live in homes comparable to those of junior executives in other municipalities. The rubber industry has been remarkably stable, wages have been good and employment has been maintained at a high level, he said.

Following are abstracts of technical papers presented at the conference (*denoting speaker of co-authored papers):

Advances in Silicone Rubber Polymers and Compounding, *by C. W. Roush (Dow Corning) and A. M. Dunlop* (Dow Corning Canada).* The physical chemistry of silicone rubber polymers is described. Relationships are drawn between modifications of the basic siloxane molecule and physical properties. Fillers and additives for silicone rubbers are discussed. Examples are given to show how this knowledge can be used by compounders and fabricators to manufacture silicone rubbers equivalent to those produced by silicone manufacturing companies.

Polyurethane Elastomers, *by M. Borr (Dominion Rubber).* The chemistry, processing, properties and applications of urethane elastomers are discussed. Noncellular elastomers may be divided into two main groups: millable gums and liquid polymers. The solid gums may be cured with excess polyisocyanate, sulfur or a peroxide, and can be processed on conventional rubber equipment. The liquid urethanes are processed in the liquid state by mixing with a curing agent and casting into molds, coating or spraying. Cure is effected mainly with polyamines or polyols.

The Dynamic Mechanical Properties of Some New Elastomers, *by A. D. Dingle (Dunlop).* The dynamic properties of power loss (hysteresis), resilience and modulus as a continuous function of temperature over the range —40° to 150° C. have been determined on a number of newer elastomers. Polyisoprenes, polybutadienes, ethylene-propylene copolymers and butyl rubbers of higher unsaturation were tested.

Improved Synthetic Rubbers for the Modern Tire, *by T. A. Ruehl (Goodyear).* Two new polymers, *cis*-polyisoprene and *cis*-polybutadiene, have been developed and are showing outstanding possibilities as re-

placements for natural rubber. These rubbers come closer to approaching the structure and configuration of natural rubber than any other polymers yet developed. Other synthetic polymers finding greater use in tires are neoprene and butyl. New polymers still under the early stages of development include vinyl pyridine rubbers, ethylene-propylene copolymers and polyurethane.

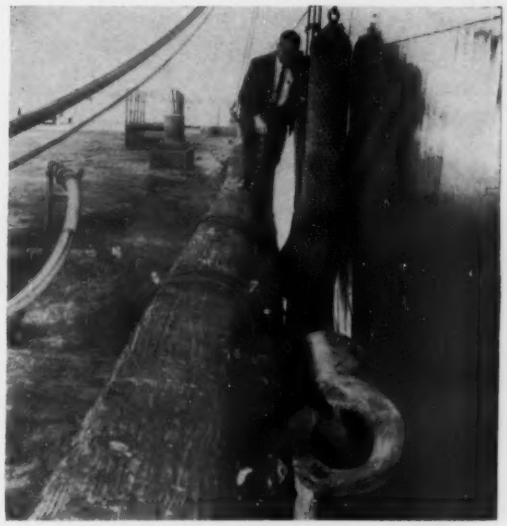
Rheological Measurements on Elastomers with the Brabender Plastograph, *by Dr. C. C. McCabe (DuPont).* Rheological properties of elastomers are of primary importance during processing and must be maintained within certain limits for sucfessful operation. The shear stress vs. shear rate relationship appears most effective in characterizing elastomers. The Brabender Plastograph affords a means of measuring rheological characteristics as a function of shear rate and temperature in either uncompounded or compounded stocks.

Measurement of Dispersion of Carbon Black in Rubber, *by A. I. Medalia (Godfrey L. Cabot).* Various methods for measuring degree of carbon black dispersion are reviewed. Of these, the method developed at Dunlop is preferred. This method involves sectioning of the frozen rubber with a microtome, followed by microscopic examination. This reveals extent to which pellets are broken down. Dispersion of the individual carbon black particles is determined by light microscopy at 1000X and by the electron microscope.

Antiozonant Blends and Their Testing, *by J. Payne (Monsanto Ltd.).* The use of blends of antiozonants of the paraphenylene diamine and the alkylated dihydroquinoline type are considered in detail and experimental evidence is presented to show that these two types of antiozonants differ in their mode of action. A tentative explanation is put forward to explain the difference in behavior of the two types.

Determination of Physical Properties of a Five-Gram Sample of Rubber, *by J. Briggs, E. Kent, W. Embree, W. H. Watson* (Polymer Corp. Ltd).* This paper describes the development and use of micro rubber evaluation equipment, whereby it is possible to get a complete compound using as little as 5 grams of polymer and, in some cases, half this amount. The mixing techniques, the curing procedure, the sample preparation and testing are outlined, and a comparison is made between the results obtained on the small sample and those obtained using ASTM testing procedures. Tests other than stress-strain are also described and reference is made to the development of procedures for compounding similar size samples on an internal mixer. It is possible to develop mixing procedures applicable to larger scale mixing equipment, based on the experience obtained on the micro mill rolls. It is shown that complete physical testing is practical on such small samples, so that one may accurately predict the results that will be obtained when larger size samples are available and conventional mixing employed.

► A data sheet illustrating and describing a new light push-pull tester and LST test stand has been made available by Testing Machines, Inc., Mineola, N. Y.



Traffic manager, William Heath, of the West India Fruit and Steamship Co. looks on as one of the firm's ships drives into the new rubber shock absorber in one of the tests.

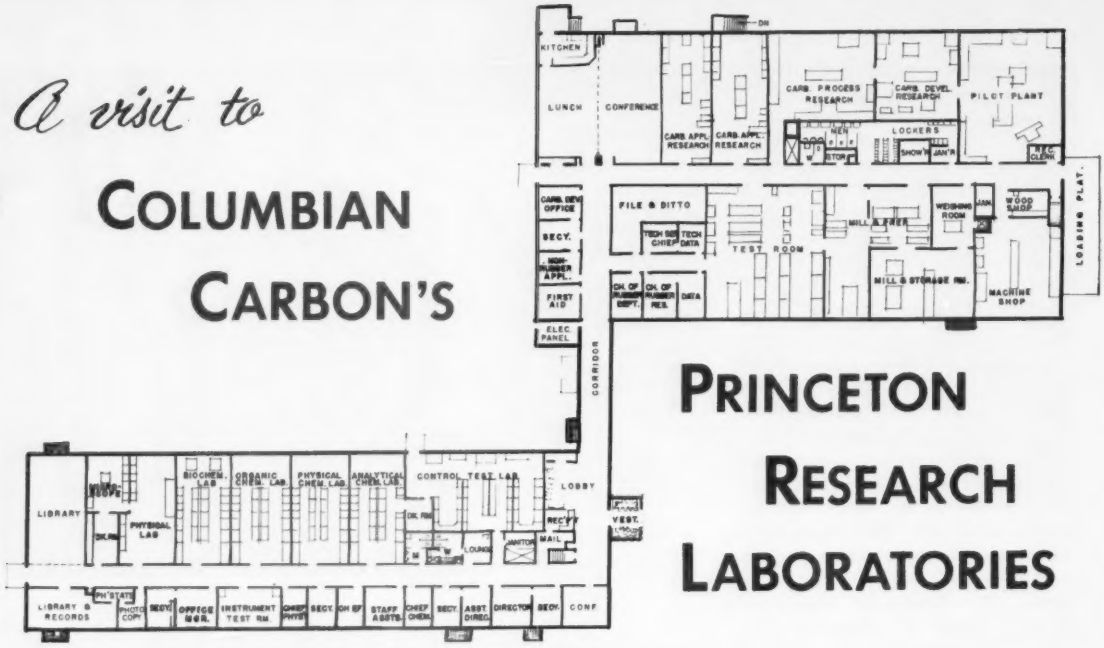
Goodyear Introduces Dock Fender

► A giant tube of synthetic rubber that is said to withstand impacts of nearly 300,000 pounds per foot has been introduced by the Goodyear Tire & Rubber Co., Akron, Ohio. The new shock absorber was displayed at the 48th Annual Conference of the American Association of Port Authorities, which was held recently in West Palm Beach, Fla. The new fender was part of the first full-scale exhibit of port equipment shown in conjunction with the annual meeting. The new synthetic rubber product enables pier designers to construct lighter, more streamlined structures at lower cost and virtually eliminates damages to piers and dolphins caused by the crushing weight of docking ships, according to the company.

The fender is 21 inches across the outside diameter and 10½ inches on the inside diameter. A one foot section weighs 135 pounds and will absorb 45,700 foot-pounds of kinetic energy. One of the major features of the new fender is a better load-energy absorption ratio. For every foot-pound of energy absorbed by the fender, a load of 2.25 pounds is transmitted to the dock or pier. Rubber dock fenders, used in virtually all major world ports, can be draped over pier walls like scallops by chain or cable, wrapped around dolphins on pier corners or built into special rubber - timber sandwiches. The fenders are manufactured by extrusion and contain a mildew inhibitor and chemicals which resist deteriorating action of salt water, ozone, sunlight and marine bacteria, the company states.

A visit to

COLUMBIAN CARBON'S PRINCETON RESEARCH LABORATORIES

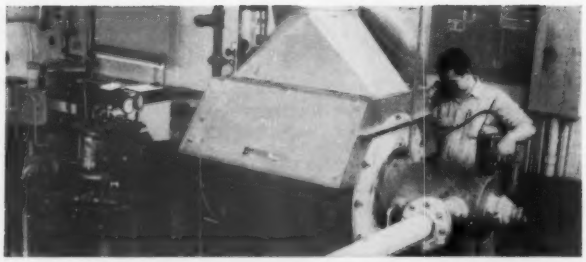


OIL ADSORPTION of blacks is tested in analytical chem lab.

► New and greatly enlarged facilities for research into the physics, chemistry and application of carbon black are provided by Columbian Carbon's recently dedicated research headquarters near Princeton, N. J.

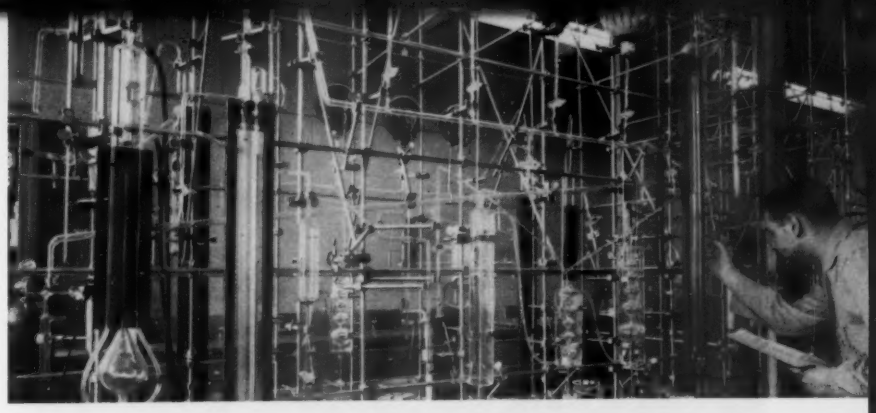
Costing over one million dollars, the new headquarters is located on a 14-acre plot on the Plainsboro Road, just off U. S. Highway No. 1. Virtually completed in December of 1958 but still expanding, it consists of two connected buildings—the first comprising six laboratories devoted to basic chemical and physical research, the second housing seven laboratories for development and application research. The former has a total floor space area of 12,000 square feet and encompasses the main entrance, reception area, administrative offices, library and file rooms. Connected to it by a 10-foot corridor, the second laboratory building, with 18,000 square feet of floor space, contains a lunchroom, large

PILOT PLANT features an automated experimental furnace.



RUBBER TEST LAB equipment includes Mooney Viscometer, shown below.

ELECTRON MICROSCOPE in physical lab shows molecular structure of blacks.



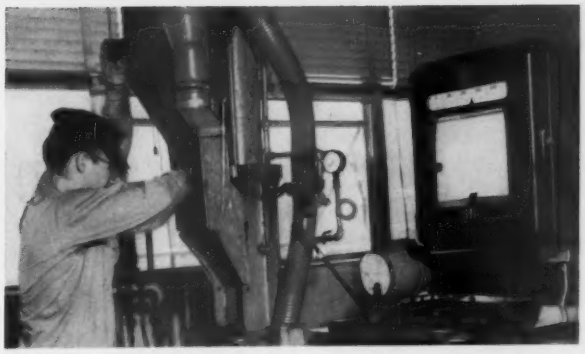
NITROGEN ADSORPTION apparatus used for surface area studies in phys. chem lab.

conference room, machine and maintenance shops, shower and locker rooms.

A finished basement area of 6,000 square feet provides storage rooms, boiler and heating plants, air-conditioners and other service equipment. The exterior of the buildings is brick and glass. Multi-colored enamel brick beautifies the facades and a cornice detail of colored porcelain enamel completely surrounds the structure. The interior is as free as possible from bearing walls to afford flexibility for future expansion and rearrangement of partitions.

The laboratory staff consists of about 75 persons, of whom 30 are graduates, 30 junior technicians and 15 maintenance and clerical workers. All phases of carbon black development, evaluation and application are covered in the research program. Work is also being done on other pigments, technical services furnished to the rubber and non-rubber industries, and investigations launched into new products in the pigment, polymer and organic fields.

Of special interest is the space assigned to the rubber division, including a compound-mill-press-preparation room of approximately 2,500 square feet and a test room of 1,800 square feet. With its adjacent offices and file rooms, this division forms a compact, integrated unit designed to handle parallel research and technical service activities in all aspects of rubber technology at maximum efficiency. The latest equipment is being utilized here as in the carbon black labs — electron microscopes, Banbury mixers, various flexometers, vapor fractometers, electric platen presses and adsorption apparatus — some of it depicted in the photographs on these two pages.



BANBURY MIXER, completely instrumented, in mill room of rubber lab.

CONFERENCE ROOM at the research center illustrates functional interior decor.

137th ACS Meeting Features Interesting Papers on Rubber

► A number of papers of specific interest to the rubber industry were presented during the 137th National Meeting of the American Chemical Society held on April 5 to 14 in Cleveland, Ohio. During the sessions of the Division of Polymer Chemistry, for example, G. D. Cooper and F. F. Holub (G-E), presented a paper on "Oriented Irradiated Silicone Rubber." The authors reported that strips of peroxide cross-linked silicone rubber were stretched and further cross-linked by irradiation with high energy electrons in the stretched condition. It was shown that very extensive bond rearrangement occurs during irradiation.

In another paper, "Radiation-Induced Graft Copolymerization. The Accelerating Effect on Methanol," the authors, G. G. Odian, Albert Rossi and E. N. Trachtenberg (Radiation Applications), observed that in the radiation-induced graft copolymerization of styrene to polyethylene, dilution of styrene with methanol enhances the rate of styrene grafting, with the maximum effect occurring at approximately 50 per cent methanol concentration. According to the authors, the observed accelerative influence of the methanol may best be explained by a Trommsdorff - type effect.

L. H. Tung (Dow Chemical) stated in his paper on "Belt Viscosity of Polyethylene," that melt viscosities of polyethylene fractions were measured at low rates of shear in a cone and plate rotational viscometer. More accurate molecular weight determinations could be made on these fractions, because they were free from particular matter which is known to be present in unfractionated polyethylenes and to interfere with light scattering molecular weight determinations.

In their paper on "Structure and Properties of Phenylene Sulfide Polymers," R. W. Lenz and C. E. Handlovitz (Dow Chemical) pointed out that phenylene sulfide polymers prepared by the Macallum (*J. Org. Chem.*, 13, 1954, 1948) polymerization of *p*-dichlorobenzene, sulfur, and sodium carbonate with and without 1,2,4 - trichlorobenzene were compared to a linear polyphenylene sulfide prepared by the self-condensation of sodium *p*-chlorothiopenoxide. The linear polyphenylene sulfide and the Macallum polymers were found to be essentially identical in all of these properties although the sulfur contents of the latter were generally higher than of the former by 15 to 20 per cent of the amount present.

Acrylic Polymers

In a paper on "Crystalline Acrylic Polymers. Mechanism Studies," it was stated by the authors, W. E. Goode, F. H. Owens and W. L. Myers (Rohm and Haas), that the polymerization of methyl methacrylate and isopropyl acrylate in toluene with phenyl-H^3-magnesium bromide has been studied at 0° and minus 70°C., respectively. Comparison of number average molecular weights calculated from measuremenas of radioactivity and from measurements of appropriate colligative properties has shown that there is one and only one phenyl group per chain. Thus, initiation in this system is by 1,4-addition of the organomagnesium compound to the monomer.

Acrylamide crystals irradiated with gamma rays at —78°C. were polymerized at temperatures from 25° to 60°C. following the polymer yield and molecular weight as a function of time, stated H. Morawetz, T. A. Fadner and I. Rubin (Brooklyn Polytechnic) in their paper on "Vinyl Polymerization in the Crystalline State: A Progress Report." Although the rate decayed rapidly, the polymerization did not cease even after several months. The authors presented data that showed that chain transfer is negligible and the chain length of the product depended only on polymerization time and temperature, but not in the irradiation dose.

Robert A. Mendelson (Monsanto) pointed out in his paper "High Pressure Polyethylene Molecular Dimensions as Estimated From Solution Properties of Whole Polymers," that solution light scattering, osmotic pressure, and viscosity measurements at elevated temperatures in non-ideal solvents were performed to characterize the M_w's, M_n's, mean-square end-to-end distances, R^2z, and second virial coefficients, A_2, of 17 whole polymer samples of high pressure polyethylene (HPPE) and of five fractions of one of these whole polymers. The data were treated to eliminate the effects of excluded volume and of poly-dispersity on the molecular dimensions.

"The Emulsion Polymerization of Vinyl Acetate, Part I," was a paper presented by R. Patsiga, M. Litt and V. Stannett (State University College of Forestry, Syracuse, N. Y.). The authors reported that polyvinyl acetate seed of 0.030 micron diameter was prepared and used in seeded polymerization of vinyl acetate and styrene. Rates of polymerization and final particle sizes were measured for various seed concentrations. It was found that many of the seed particles coalesced when monomer was added, and their survival depended upon the dilution of the seed.

The Division of Paint, Plastics, and Printing Ink Chemistry sponsored a Symposium on Adhesion at which was presented a paper on "Measurement of Adhesion by a Blister Method," by Hans Dannenberg (Shell Development). The author noted that an instrument for measurement of adhesion of organic coatings has been developed. It is based on the formation of a blister by injecting a liquid (mostly mercury) under pressure between the coating and the substrate. Design and operation of the instrument are described, an evaluation of its performance and limitations is given, and examples of its application are presented.

A paper on "Theory and Analysis of Peel Adhesion: Rate-Temperature Dependence of Viscoelastic Interlayers" was presented by D. H. Kaelble (Minnesota Mining & Mfg.). Mr. Kaelble said that a theoretical treatment has been developed which concerns the magnitude and rate-temperature dependence of peel force for bonds comprising viscoelastic adhesive interlayers. From "master curves" of the interlayer dynamic moduli and ultimate stress or strain one may calculate a peel force "master curve."

In a paper on "Structural Bond-

ing of Polyolefins," Richard G. Baker and Arthur T. Spencer (Bell Telephone Laboratories) reported on how the project of developing structural bonds between beryllium copper and low density polyethylene was undertaken to provide thoroughly reliable seals for submarine cable applications. The new method depends on the chemical formation of a cupric oxide layer on the metal with subsequent bonding of the polyethylene in a short time, high-temperature molding operation using no intermediate adhesive layer.

"Types of Bonds Involved in Adhesion of an Epoxy Resin to Steel and Aluminum," by George J. Barenholtz, I. C. Chu, and John E. Rutzler, Jr., (Case Institute of Technology) dealt with the topic of how an epoxy resin, 3,4-epoxy-6-methylcyclohexylmethyl 3,4 - epoxy - 6 - methylcyclohexanecarboxylate cured with maleic anhydride and trimethylol propane, was heated to different temperatures in an apparatus in which the amount of gas evolved at various temperatures was measured and then analyzed by means of a mass spectograph. Measurements and analyses were made on the unfilled resin and the resin filled with aluminum, aluminum oxide, and steel in separate experiments.

Adhesion Discussed

Hideshi Sato and John E. Rutzler, Jr. (Case Institute of Technology) presented a paper on "Adhesion and the Surfaces of Mechanically Ruptured Polymers." The authors discussed how the relatively stable free radical, diphenylpicrylhydrazyl was employed to test for the formation of free radicals when polyethylene, polytetrafluoroethylene, polyvinyl chloride and films of two adhesives were cut mechanically. Free radicals were produced in different quantities by mechanical disruption of the polymers.

"A Series of Vinyl Copolymer Elastomers I. Vulcanizate Properties" was presented by H. M. Leeper, O. deS. Deex, W. G. Bir, I. O. Salyer, J. D. Calfee, and J. M. Butler (Monsanto Chemical). The authors said that through vinyl copolymerization Monsanto has produced a series of curable elastomers which may be compounded and processed through conventional techniques to give vulcanized rubbers with combinations of properties not available in any of today's commercial rubbers. The elastomers are preferably cured with moderate concentrations of di-cumyl peroxide in any of its commercially available forms, by di-tert-butyl peroxide, or by the commercial peroxide, Barox.

Another paper, on "Effect of the 2,6-Isomer Content in Toluene Diisocyanate on Properties of Urethane Polymers," by S. Edmund Berger, Frank L. Cataldo, Frank J. Dwyer, and Herman Stone (Allied Chemical) commented that it is well established that in the reaction of toluene diisocyanate (TDI) with compounds containing active hydrogens, the 2,4-isomer is much more reactive than the 2,6-isomer. Contrary to expectation it has been shown that under certain conditions, 2,6-TDI can behave as if it were the more reactive isomer. It was demonstrated in this paper that in any one prepolymer formulation equivalent changes in foam properties can be brought about by changing the postheating cycle or the isomer ratio of the TDI.

Furniture for Space Travel

► American Latex Products Corp., division of the Dayton Rubber Co., Hawthorne, Calif., has developed a custom-molded space couch consisting of Stafoam urethane foamed plastic for use by Astronauts who will pilot manned space capsules. The couches, which are molded individually for each Astronaut, have been engineered to protect the explorer in space against the stresses of blastoff and descent and to contribute comfort during space flight. The couches were prepared for use in the prototype space capsule under development by the Astro Systems and Research Laboratories, Norair, Division of Northrop Corp.

The plastic cushioning is said to have protective and stress-relieving properties and to provide insulation against the extreme temperature variations of space travel. A coating of Hypalon flexible plastic is applied over the surface of the molded Stafoam. The space couches have been designed to distribute the Astronaut's weight to best absorb the shock of acceleration; to protect the Astronaut against the shock of his descent-parachute opening on return to earth; and to cushion his actual earth landing. In orbit, the Astronaut can adjust his visual attitude by rotating the space capsule with control rockets, according to the company.

Rubber Manufacturing Industry Plant Vacation Schedules

As a service to the rubber industry and its suppliers, there appears below a listing of those companies which have announced vacation schedules during which time the plants will close. It may be said, however, that many of the companies involved will maintain standby staffs during the period. The dates appearing after each company name may or may not be inclusive and appear as reported by the individual concerns. Where more than one plant is involved, the listing will so state. The listings are, of course, published for guidance only.

United States

A

Accurate Mfg. Co., Garfield, N. J. (July 2-July 18).
Accurate Products Co., San Diego, Calif. (June 25-July 11).
Ace Rubber Products, Inc., Akron, Ohio (July 4-July 11).
Acushnet Process Co., New Bedford, Mass. (July 4-July 17).
Aldan Rubber Co., Philadelphia, Penna. (July 25-Aug. 8).
Alphaduct Wire & Cable Co., New Brunswick, N. J. (July 3-July 17).
Amazon Rubber Co. Akron, Ohio (June 25-July 11).
American Biltrite Rubber Co., Trenton, N. J. (July 3-July 17).
American Finish & Chemical Co., Chelsea, Mass. (July 1-July 11).
American Hard Rubber Co. (Tallapoosa, Ga., July 11-July 18); (Akron, Ohio, July 3-July 17).
American Rubber Corp., Albertville, Ala. (June 25-July 10).
Ames Rubber Corp., Hamburg, N. J. (July 15-Aug. 1).
Anaconda Wire & Cable Co. (Orange, Calif., July 11-July 24); (Marion, Ind., July 25-Aug. 7); (Hastings, N. Y., July 18-July 31); (Watkinsville, Ga., July 11-July 17).
Apex Molded Products Co. Philadelphia, Penna. (July 16-Aug. 1).
Arjay Plastic Products, Ridgefield Park, N. J. (July 16-Aug. 1).
Armstrong Rubber Co. (West Haven, Conn. & Des Moines, Iowa, Aug. 22-Sept. 5); (Natchez Tenn., July 4-July 11).
Armstrong Rubber Mfg. Co., Des Moines, Iowa (Aug. 20-Sept. 6).
A-S-H Molded Products Co., Malvern, Penna. (July 1-July 11).
Associated Gaskets, Inc., Bridgeport, Conn. (June 30-July 11).
Avon Sole Co., Avon, Mass. (June 27-July 11).

B

Badger Outerwear Mfg. Co., Port Washington, Wisc. (July 2-July 10).
Bak-Co Mfg. Co. Tenafly, N. J. (Aug. 1-Aug. 15).
Barco Mfg. Co., Barrington, Ill. (July 18-Aug. 1).
Barge Cement Mfg. Co., Towaco, N. J. (July 4-July 16).
F. P. Bartlett & Co., Canton, Mass. (June 27-July 8).
Bata Shoe Co., Belcamp, Md. (July 3-July 17).
B. B. Chemical Co. (Cambridge, Mass., July 1-July 18); (Middleton, Mass., July 4-July 18).
Beebe Rubber Co., Nashua, N. H. (July 3-July 18).
Behr-Manning Co., Troy, N. Y. (July 15-Aug. 1).
Belko Corp., Kingsville, Md. (July 2-July 11).
Richard Best Pencil Co., Springfield, N. J. (July 23-Aug. 7).
L. M. Bickett Co., Watertown, Wisc. (July 3-July 10).
Borden Chemical Co., Coatings & Adhesives Dept. (Peabody, Mass. July 2-July 18); (Middlesex, N. J., July 9-July 25).
Boston Insulated Wire & Cable Co., Boston, Mass. (July 1-July 18).
Bowes "Seal Fast" Corp., Indianapolis, Ind. (July 3-July 18).
Bristol Mfg. Corp., Bristol, R. I. (July 30-Aug. 15).
Arthur S. Brown Mfg. Co., Tilton, N. H. (July 1-July 17).
Brunswick-Balke-Collender Co., Muskegon, Mich. (July 1-July 11).
Buffalo Weaving & Belting Co., Buffalo, N. Y. (July 18-July 30).

C

Cambridge Chemical Co., Cambridge, Mass. (July 1-July 11).
Cambridge Rubber Co., Taneytown, Md. (July 1-July 18).
H. O. Canfield Co., Clifton Forge, Va. (July 2-July 11).
Carr Mfg. Corp., Bristol, R. I. (July 2-July 17).
Cartex Corp., Morrisville, Penna. (July 1-July 18).
Chardon Rubber Co., Chardon Ohio (June 25-July 5).
Charleston Rubber Co., Charleston, S. C. (July 4-July 29).
Chemical Products, Inc., Detroit, Mich. (July 22-Aug. 12).
Chemical Rubber Products, Inc., Beacon, N. Y. (July 2-July 17).
Chicago Allis Mfg. Corp., Chicago, Ill. (July 2-July 19).
Circle Wire & Cable Corp., Maspeth, N. Y. (July 3-July 17).
Clevite Harris Products, Inc. (Milan, Ohio, & Napoleon, Ohio, July 17-Aug. 1).
Collette Mfg. Co., Amsterdam, N. Y. (July 1-July 10).
Collyer Insulated Wire Co., Pawtucket, R. I. (July 4-July 16).
Colonial Rubber Co., Ravenna, Ohio (June 25-July 11).
Congoleum-Nairn, Inc. (Marcus Hook, Penna. & Trenton, N. J., July 4-July 18).
Conneaut Rubber & Plastics Co., Conneaut, Ohio (July 4-July 18).
Connecticut Hard Rubber Co., New Haven, Conn. (July 24-Aug. 7).
Consolidated Rubber Mfg. Co., Bloomfield, N. J. (July 11-July 24).
Continental Rubber Works, Erie, Penna. (July 3-July 16).
Continental Tapes & Continental Chemical Co., Cayce, S. C. (June 24-July 5).
Converse Rubber Co., Malden, Mass. (July 23-Aug. 7).
Herbert Cooper Co., Genesee, Penna. (Aug. 22-Aug. 29).
Cooper Tire & Rubber Co., Findlay, Ohio (Aug. 29-Sept. 6)
Cornish Wire Co. (New York, N. Y. & Williamstown, Mass., July 3-July 18).
Crown Products Co., Ralston, Nebr. (June 24-July 11).
Crown Rubber Co., Fremont, Ohio (July 2-July 17).
Crunden Martin Mfg. Co., St. Louis, Mo. (July 1-July 16).

D

Darling Valve & Mfg. Co., Williamsport, Penna. (July 4-July 17).
Davol Rubber Co., Providence, R. I. (July 15-Aug. 1).
De Laval Separator Co., Poughkeepsie, N. Y. (July 15-Aug. 1).
Delco Rubber Corp., Millbury, Mass. (July 1-July 11).
Denman Rubber Mfg. Co., Warren, Ohio (July 3-July 10).
A. P. De Sanno & Son, Inc., Phoenixville, Penna. (July 25-Aug. 6).
Dill Mfg. Co., Cleveland, Ohio (July 11-July 25).
Joseph Dixon Crucible Co., Jersey City, N. J. (July 18-July 31).
Dunlop Tire & Rubber Corp., Buffalo, N. Y. July 25-Aug. 8).
Durable Display Mfg., Inc., Chicago, Ill. (July 2-July 17).
Durkee-Atwood Co., Red Wing, Minn. (June 24-July 11).

E

Eagle Rubber Co., Ashland, Ohio (June 27-July 5).
Eastern Molding Co., Belleville, N. J. (July 1-July 11).
Easthampton Rubber Thread Co., Easthampton, Mass. (July 2-July 11).
Eclat Rubber Co., Akron, Ohio (July 4-July 18).
Thomas A. Edison Industries, Storage Battery Div., West Orange, N. J. (July 1-July 23).
Edmont, Inc., Coshocton, Ohio (July 4-July 17).
Electric Hose & Rubber Co., Wilmington, Del. (July 24-Aug. 7).
Elgo Rubber Products Co., Philadelphia, Penna. (July 2-July 17).
Elfskin Corp., Worcester, Mass. (July 4-July 9).
Endicott Johnson Corp. (Binghamton, Johnson City and Endicott, N. Y., July 15-July 25).
Enduro Rubber Co., Ravenna, Ohio (July 2-July 18).
Essex Rubber Co., Trenton, N. J. (July 3-July 10).
Excel Rubber Co., Goshen, Ind. (July 2-July 18).

F

A. W. Faber Castell Pencil Co., Newark, N. J. (July 4-July 17).
Eberhard Faber, Inc., Rubber Div., Newark, N. J. (July 4-July 18).
Faultless Rubber Co., Ashland, Ohio (June 24-July 11).
Fibre Leather Mfg. Co., New Bedford, Mass. (July 2-July 11).
Flexible Tubing Corp., Guilford, Conn. (June 30-July 11).
Fo-Mac Enterprises, Inc., Tulsa, Okla. (July 1-July 18).

G

Garrett Flexible Products, Inc., Garrett, Ind. (June 27-July 11).
Gavitt Wire & Cable Co., Brookfield, Mass. (July 2-July 18).
General Cable Corp., Concord, N. H. (July 2-July 18).
General Latex & Chemical Corp., Cambridge, Mass. (July 1-July 18).
General Latex & Chemical Corp. (of N.C.), Charlotte, N. C. (July 1-July 18).
General Rubber Corp., Tenafly, N. J. (Aug. 1-Aug. 15).
General Tire & Rubber Co. (Jeannette, Penna., July 2-July 10); (Akron, Ohio, June 27-July 5).
Geschwind Foam Rubber Co., Staten Island, N. Y. (July 4-July 18).
Goodall Rubber Co., Trenton, N. J. (July 24-Aug. 7).
Goodall Sanford, Inc., Reading, Mass. (July 2-July 11).
B. F. Goodrich Co., Footwear & Flooring Div., Watertown, Mass. (July 18-Aug. 1).
Goodyear Footwear Corp., Providence, R. I. (July 1-July 18).
Goodyear Rubber Co., Middletown, Conn. (July 23-Aug. 7).
Goodyear Tire & Rubber Co. (Topeka, Kans. & Windsor, Vt., July 4-July 11); (New Bedford, Mass., July 4-July 18).
Goshen Rubber Co., Goshen, Ind. (July 4-July 10).
W. R. Grace & Co., Dewey & Almy Div. (Adams Mass., July 1-July 15); (Cambridge, Mass., July 18-July 30).
Greising Engineering Co., Runnemede, N. J. (July 4-July 18).

H

Haartz-Mason, Inc., Watertown, Mass. (July 2-July 11).
Hagerstown Rubber Co., Hagerstown, Md. (July 1-July 11).
Wm. R. Hall & Son Co., Philadelphia, Penna. (June 30-July 18).
Hamilton Rubber Mfg. Corp., Trenton, N. J. (July 25-Aug. 7).
Hawthorne Rubber Mfg. Co., Hawthorne, N. J. (July 1-July 18).
Hecht Rubber Co., Jacksonville, Fla. (July 1-July 7).

Henry Engineering Co Moline, Ill. (June 27-July 11).
Hercules Packing Corp., Conneaut, Ohio (July 11-July 25).
Hershberg Rubber Products Co., Ashtabula, Ohio (July 2-July 17).
Hewitt-Robins, Inc. (Franklin, N. J., July 4-July 17); (Buffalo, N. Y., July 18-Aug. 1).
Hoover Co., North Canton, Ohio (July 18-July 31).
Houghton Vix-Syn Co., Minneapolis, Minn. (July 1-July 11).
Huron Rubber Co., Norwalk, Ohio (July 2-July 11).

I

Ideal Roller & Mfg. Co. (Chicago, Ill., Long Island City, N. Y., Huntington Park, Calif., Chamblee, Ga., July 17-Aug. 1).
Ideal Tape, Inc., Lowell, Mass. (July 2-July 11).
Imperial Rubber Mfg. Co., Hackettstown, N. J. (July 1-July 9).
Improved Machinery, Inc., Nashua, N. H. (July 16-July 31).
Industrial Rubber Corp., Brooklyn, N. Y. (July 1-July 12).
Interchemical Corp., Wadsworth & Woodman Div., Winthrop, Maine (July 4-July 16).
International Packings Corp., Bristol, N. H. (June 25-July 3).

J

Jacobs Rubber, Danielson, Conn. (July 2-July 10).
Jasper Rubber Products, Inc., Jasper, Ind. (July 4-July 12).
Jewel-Sheen Coating, Inc., Long Island City, N. Y. (July 2-July 17).
Johnson & Johnson (New Brunswick, N. J., July 17-Aug. 1); (Chicago, Ill., July 4-July 11 and Aug. 22-Aug. 29); (Dallas, Texas, June 26-July 3).
Joy Mfg. Co., Electrical Products Div., St. Louis, Mo. (Aug. 8-Aug. 22).

K

K & M Rubber Co., Maywood, Ill. (July 4-July 15).
Kaiser Aluminum & Chemical Corp., Bristol, R. I. (July 4-July 15).
Kame-Tex Mfg. Corp., Yardville, N. J. (July 3-July 17).
Karpex Mfg. Co., Indianapolis, Ind. (July 2-July 18).
Kendall Co. (Chicago, Ill., July 2-July 18); (Franklin, Ky., July 3-July 11).
Kennedy Mfg. Corp., Stoughton, Mass. (July 1-July 18).
Kenworthy Brothers Co., Westborough, Mass. (July 2-July 18).
Kitco Engineering & Mfg. Co., Bluffton, Ind. (June 27-July 8).
Kleen-Stik Products, Inc., Newark, N. J. (July 5-July 17).
Koneta Rubber Co., Wapakoneta, Ohio (July 4-July 18).

L

LaCrosse Rubber Mills Co., LaCrosse, Wisc. (June 25-July 16).
LaFavorite Rubber Mfg. Co., Hawthorne, N. J. (June 30-July 18).
Latex Fiber Industries, Inc., Beaver Falls, N. Y. (July 3-July 10).
Laurel Co., Garfield, N. J. (July 18-Aug. 1).
Lavelle Rubber Mfg. Corp., Burlington, Wisc. (July 16-July 31).
Lawrence Adhesive & Chemical Co., Lawrence, Mass. (April 1-April 18).
Lawrence Hose Co., Trenton, N. J. (July 25-Aug. 8).
W. S. Libby Co., Lewiston, Maine (July 3-July 10).
H. C. Lien Rubber Co., Los Angeles, Calif. (July 17-July 31).
Lloyd Mfg. Co., Warwick, R. I. (July 4-July 18).
Lorraine Mfg. Div., National Phoenix Ind., Maywood, N. J. (July 22-Aug. 8).
Lovell Mfg. Co., Erie, Penna. (July 24-Aug. 6).
Luzerne Rubber Co., Trenton, N. J. (July 2-July 18).

M

Magee Carpet Co., Bloomsburg, Penna. (July 2-July 17).
Major Chemical & Latex Corp., Boston, Mass. (July 1-July 18).
Mannequins by Mayorga, Inc., New York, N. Y. (July 1-July 30).
Mayfair Molded Products Corp., Schiller Park, Ill. (Rubber Div., July 18-July 29; Plastics Div., July 4-July 15).
McCormick Rubber Co., Ridgefield Park, N. J. (July 16-Aug. 1).
McCreary Tire & Rubber Co., Indiana, Penna. (July 3-July 11).
Mercer Rubber Co., Hamilton Square, N. J. (July 18-July 29).
Mercer Rubber Corp., Little Ferry, N. J. (July 8-July 25).
Metropolitan Golf Ball Inc., Santa Monica, Calif. (Aug. 13-Sept. 12).
Mine Safety Appliances Co., Pittsburgh, Penna. (July 25-Aug. 8).
Minnesota Rubber Co., Minneapolis, Minn. (June 24-July 1.)
Mohawk Rubber Co., Akron, Ohio (July 1-July 11).
Molded Rubber Specialties, Inc., Glendale, Calif. (July 1-July 9).

N

Neff-Perkins Co., Painesville, Ohio (July 1-July 17).
Newth Rubber Co., Barrington, R. I. (July 2-July 17).

O

Odell Co., Watertown, Mass. (July 2-July 11).
Okonite Co. (North Brunswick, Passaic and Paterson, N. J., July 11-July 25).
O'Sullivan Rubber Corp., Winchester, Va. (June 27-July 5).

P

Pantasote Co., Passaic, N. J. (July 1-July 18).
Parke, Davis & Co., Bay Div., Bridgeport, Conn. (July 11-July 25).
Paul-Martin Rubber Corp., Holyoke, Mass. (July 2-July 11).
Pawling Rubber Corp., Pawling, N. J. (July 18-July 25).
Pioneer Rubber Co., Willard, Ohio (July 2-July 18).
Plabell Rubber Products, Inc., Toledo, Ohio (July 2-July 11).
Plymouth Rubber Co., Canton, Mass. (July 1-July 11).
Polyfoam Products Co., Los Angeles, Calif. (May 27-June 6).
Poly Products Co., Spartanburg, S. C. (July 4-July 11).
Precision Rubber Products Corp., Dayton, Ohio (Aug. 1-Aug. 15).
Precision Thread Co., Fall River, Mass. (July 2-July 10).
Pretty Products, Inc., Coshocton, Ohio (July 25-Aug. 8).
Pulaski Rubber Co., Pulaski, Tenn. (July 18-July 25).
Pyramid Rubber Co., Ravenna, Ohio (July 2-July 17).

Q

Quabaug Rubber Co., North Brookfield, Mass. (July 3-July 10).

R

Rapid Roller Co., Chicago, Ill. (July 25-Aug. 8).
Raybestos-Manhattan, Inc. (Passaic, N. J., July 22-Aug. 8); (Bridgeport, Conn., July 15-July 25); (Manheim, Penna., July 2-July 11).
R.C.A. Rubber Co., Akron, Ohio (July 4-July 18).
Republic Rubber, Youngstown, Ohio (July 16-Aug. 1).
Rhee Elastic Thread Corp., Warren, R. I. (July 1-July 18).
Richardson Co., Melrose Park, Ill. (June 27-July 10).
Roberts Toledo Rubber Co., Toledo, Ohio (July 3-July 10).
Rodic Chemical & Rubber Corp., New Brunswick, N. J. (July 25-Aug. 8).
John A. Roebling's Sons, Trenton, N. J. (July 4-July 17).
Rogers Corp. (South Windham, Conn., July 2-July 8); (Willimantic, Conn., July 4-July 19).
Roppe Rubber Co., Fostoria, Ohio (July 1-July 11).
Ross & Roberts, Inc., Stratford, Conn. (July 3-July 17).
Roth Rubber Co., Cicero, Ill. (July 15-July 31).
Rubber Corporation of Pennsylvania, West Hazleton, Penna. (July 2-July 10).
Rubber Latex Co. of America, Clifton, N. J. (July 2-July 10).
Russell Mfg. Co., Middletown, Conn. (Aug. 1-Aug. 15).

S

W. H. Salisbury & Co., Chicago, Ill. (July 1-July 18).
Sawyer-Tower, Inc., Watertown, Mass. (July 3-July 17).
Schacht Rubber Mfg. Co., Huntington, Ind. (July 1-July 18).
Julius Schmid, Inc. (New York, N. Y. and Little Falls, N. J., Aug. 15-Aug. 27).
Scully Rubber Mfg. Co., Baltimore, Md. (July 4-July 11).
Sealol, Inc., Providence, R. I. (July 15-Aug. 1).
Seamless Rubber Co., New Haven, Conn. (Aug. 1-Aug. 15).
Seiberling Latex Products, New Bremen, Ohio (July 4-July 11).
Seiberling Rubber Co., Akron, Ohio (Aug. 28-Sept. 5).
Sheller Mfg. Corp., Portland, Ind. (July 3-July 10).
Shep Rubber Mfg., Inc., St. Louis, Mo. (July 1-July 11).
Simplex Wire & Cable Co. (Cambridge, Mass., July 16-Aug. 1); (Newington, N. H., July 23-Aug. 8).
Sloan Valve Co., Chicago, Ill. (July 11-July 22).
Slomons Laboratories, Inc., Long Island City, N. Y. (July 1-July 15).
Albert D. Smith & Co., New York, N. Y. (July 2-July 17).
M. L. Snyder & Son, Inc., Philadelphia, Penna. (July 4-July 19).
Sperry Rubber & Plastics Co., Brookville, Ind. (July 4-July 18).
Stedfast Rubber Co. (Mattapan and North Easton, Mass., July 2-July 11).
Stokes Molded Products, Trenton, N. J. (July 1-July 15).
Surety Rubber Co., Carrollton, Ohio (July 3-July 11).
Syracuse Rubber Products Co., Syracuse, Ind. (July 3-July 11).

T

T & M Rubber Specialties Co., Goshen, Ind. (July 2-July 11).
Technical Industries, Inc., Wakefield, R. I. (July 1-July 18).
Technical Tape Corp., New Rochelle, N. Y. (July 1-July 15).
Tigron Latex & Chemical Corp., Stoughton, Mass. (July 4-July 11).
Timme Corp., Wilmington, N. C. (July 2-July 11).
Tingley Rubber Corp., Rahway, N. J. (July 18-July 31).
Tompkins Rubber Co., Plymouth Meeting, Penna. (July 23-Aug. 7).
Triangle Conduit & Cable Co., New Brunswick, N. J. (July 1-July 18).
Twin City Rubber Works, Minneapolis, Minn. (July 2-July 9).
Tyer Rubber Co., Andover, Mass. (July 18-July 31).

U

UBS Chemical Co. (Cambridge, Mass. and Lemont, Ill., July 4-July 17).
Union Rubber Co., Oakland, Calif. (Dec. 24-Jan. 2, 1961).
United States Rubber Co.
Washington, Ind. (July 8-July 25).
Naugatuck and Waterbury, Conn. (July 15-Aug. 8).
Providence, R. I. (July 18-Aug. 8).
Chicopee, Mass. (July 4-July 19).
Eau Claire, Wisc. (July 18-Aug. 1).
Philadelphia, Penna. (Aug. 4-Aug. 21).
Santa Ana, Calif. (July 18-July 31)
Detroit, Mich. (Aug. 15-Aug. 29).
Indianapolis, Ind. (Aug. 15-Aug. 23).
Los Angeles, Calif. (Aug. 1-Aug. 14).

V

Vail Rubber Works, Inc., St. Joseph, Mich. (July-5-July 17).
Vellumoid Co. (Taunton and Worcester, Mass., July 18-July 31).
Victor Mfg. & Gasket Co., Chicago, Ill. (July 11-July 25).
Victor Rubber Corp., Gettysburg, Penna. (July 4-July 10).
Virginia Chemical Corp., Lynchburg, Va. (July 4-July 11).

W

Walker Brothers, Conshohocken, Penna. (July 9-July 17; July 30-Aug. 7).
Waukesha Rubber Co., Waukesha, Wisc. (July 4-July 18).
Webster Rubber Co., Sabattus, Maine (July 1-July 11).
Wefco Rubber Mfg. Corp., Santa Monica, Calif. (Dec. 23-Jan. 3, 1961).
Weldon Roberts Rubber Co., Newark, N. J. (July 1-July 15).
Wellco Shoe Corp., Waynesville, N. C. (June 25-July 11).
West Co. (Phoenixville, Penna., Aug. 1-Aug. 14); (Millville, N. J., July 4-July 17).
Western Electric Co., Baltimore, Md. (July 11-July 24).
Western Insulated Wire Co., Los Angeles, Calif. (July 30-Aug. 14).
S. S. White Dental Mfg. Co., Staten Island, N. Y. (July 5-July 12).
White Rubber Co., Ravenna, Ohio (July 2-July 16).
Wild and Stevens, Rubber Mfg. Div., Woburn, Mass. (July 1-July 18).
Williamson Adhesives, Inc., Skokie, Ill. (July 11-July 22).
Wilson Rubber Co., Canton, Ohio (June 27-July 8).
Windram Mfg. Co., South Boston, Mass. (July 4-July 8).
World Bestos, New Castle, Ind. (July 4-July 10).
Worthington Ball Co., Elyria, Ohio (Aug. 20-Sept. 5).

Y

Yaleco Rubber Co., New Haven, Conn. (July 2-July 18).
Youngs Rubber Corp., Trenton, N. J. (July 18-Aug. 1).

Z

Zenith Rubber Corp., Los Angeles, Calif. (Dec. 20-Jan. 3, 1961).

Canada

A

American Wringer Co., Farnham, Que. (July 18-July 31).
Armet Industries Ltd., Guelph, Ont. (July 25-Aug. 9).
Asbestonos Corp. Ltd., St. Lambert, Que. (July 17-July 31).

B

B. B. Chemical Co. of Canada Ltd., Montreal, Que. (July 8-July 25).
Bata Shoe Co. of Canada Ltd., Batawa, Ont. (July 16-Aug. 1).
Borden Chemical Co. (Canada) Ltd., West Hill, Ont. (July 15-Aug. 1).
British Rubber Co., Ltd., Lachine, Que. (July 11-July 22).

C

Canadian General-Tower Ltd., Galt, Ont. (July 16-Aug. 2).
Canadian Technical Tape Ltd., Montreal, Que. (July 16-July 31).
Continental Rubber Ltd., Edmonton, Alberta (July 11-July 25).

D

Dominion Silk Mills Ltd., Fabricushon Div., Toronto, Ont. (July 16-Aug. 1).
Dunlop Canada Ltd., Toronto, Ont. (July 23-Aug. 8).

F

Firestone Tire & Rubber Co. of Canada Ltd., Hamilton, Ont. (July 30-Aug. 14).

G

B. F. Goodrich Canada Ltd., Kitchener, Ont. (July 23-Aug. 2).
B. F. Goodrich Sponge Products Canada Ltd., Waterville, Que. (July 16-July 24).
Goodyear Tire & Rubber Co. of Canada Ltd., Quebec City, P. Q. (July 8-July 25).

H

Huron Mfg. Co., Lachine, Que. (July 11-July 22).

M

Mansfield Rubber (Canada) Ltd., Barrie, Ont. (July 23-Aug. 9).
Miner Rubber Co. Ltd., Granby, Que. (July 18-July 31).
Minnesota Mining & Mfg. of Canada Ltd., London, Ont. (July 16-Aug. 2).

N

Northern Electric Co. Ltd., Wire & Cable Div., Lachine, Que. (July 15-Aug. 1).

P

Phillips Electric Co. Ltd., Brockville, Ont. (July 17-Aug. 1).
Pierce & Stevens Canada Ltd., Fort Erie, Ont. (July 23-Aug. 7).
Pirelli Cables Conduits Ltd., St. Jean, Que. (July 16-Aug. 1).
Playtex Ltd., Amprior, Ont. (July 25-Aug. 2).

R

Raybestos-Manhattan (Canada) Ltd., Peterborough, Ont. (July 15-Aug. 2).
Jos. Robb & Co. Ltd., Montreal, Que. (July 8-July 25).
Robinson Moulded Products Ltd., Woodbridge, Ont. (July 25-Aug. 9).
Rubbermaid (Canada) Ltd., Cooksville, Ont. (July 23-Aug. 2).

S

St. Lawrence Rubber Co., Farnham, Que. (July 18-July 31).
A. Schrader's Son, Toronto, Ont. (July 15-Aug. 2).
Seiberling Rubber Co. of Canada Ltd., Toronto, Ont. (Aug. 1-Aug. 15).
M. L. Snyder & Son Ltd., Woodbridge, Ont. (July 18-Aug. 1).
Steba Mfg. Co., Ltd., Lachine, Que. (July 11-July 22).
Sterling Rubber Co. Ltd., Guelph, Ont. (July 25-July 29).

T

Tillotson Rubber Co. Ltd., St. Johns, Que. (July 29-Aug. 15).
Triangle Conduit & Cable (Canada) Ltd., Scarborough, Ont. (July 16-Aug. 1).

W

Woodbridge Rubber Works, Woodbridge, Ont. (July 18-Aug. 1).

Y

Yale Rubber Mfg. Co. of Canada, Ltd., Kincardine, Ont. (July 25-Aug. 2).

Schulman Named Agent

► A. Schulman, Inc., Akron, Ohio has announced that it has been named exclusive United States sales agent in the plastics injection molding and extrusion industries by AviSun Corp., which recently began commercial production of polypropylene. Schulman has been marketing vinyl, polystyrene and polyethylene plastic materials for the past several years. AviSun's polypropylene will be warehoused by Schulman at key points around the country.

Wyandotte Plans Plant

► Wyandotte Chemicals Corp., Wyandotte, Mich., is negotiating for the purchase of a plant site in Washington, N. J. The company plans to construct a plant to produce its line of polyether products, including the pluronic, tetronic and pluracol compounds, at the site. The facility will be the first Wyandotte plant in the East.

Continental Builds Plant

► Continental Carbon, Amarillo, Texas, will build a $2,500,000 carbon black plant at Bakersfield, Calif., capable of producing 30 million pounds of carbon black annually. Continental Carbon is owned by Continental Oil Co., Shamrock Oil & Gas Corp., and Witco Chemical Co. The plant is due to be completed in the middle of 1961. Products will be distributed to the West Coast carbon black market by Witco.

Joins Columbian Carbon

► Columbian Carbon Co., New York, N. Y., has announced that L. F. McBride has joined the Akron, Ohio, staff of its Carbon Black and Pigment Division as a sales representative. Mr. McBride is a graduate of Dartmouth College. Prior to joining Columbian, he was purchasing agent for the Landers Corp., and also had been associated with R. H. Macy & Co.

Named Factory Manager

► E. O. Edelmann has been appointed factory manager of the West Haven, Connecticut plant of the Armstrong Rubber Co. For the past ten years, he has been assistant factory manager and a member of the staff in charge of quality and production control for all Armstrong plants. He was previously in research and tire development at Firestone Tire and Rubber Co., Akron, Ohio.

Muehlstein Moving Offices

► H. Muehlstein & Co., Inc. international processors, dealers and distributors of rubber and plastics raw materials, is moving its home office from 60 East 42nd St., to 521 Fifth Avenue, New York, N. Y. All home activities will be concentrated at one location. Muehlstein is a major dealer in raw, secondary, and reprocessed rubber and plastics.

for textiles, plastics, paints, inks and rubber

HELIOGEN® VIRIDINE 66-6001

simplifies and improves color formulation

Heliogen Viridine 66-6001 is the yellowest green phthalocyanine pigment currently available. Now, without blending, you can obtain the bright, vibrant, yellower-green shade you desire with all the excellent fastness properties of the phthalocyanines. Heliogen Viridine 66-6001 will effectively simplify your procedures and improve the color qualities of your product.

For use in the coloring of textiles, plastics, paints, inks, and rubber, this yellowest green pigment offers these notable properties:

• excellent lightfastness • excellent stability to acids and alkalies • insoluble in organic solvents • heat stable at high molding temperatures • fine dispersing qualities • non-dichromatic • high tinctorial strength

To meet individual requirements, Heliogen Viridine 66-6001 is supplied as: toner, presscake, dispersed powder, lakes, aqueous dispersions, and flushed in suitable vehicles.

Give your products extra sales appeal with a fresh, vital new shade — Heliogen Viridine 66-6001. For competent technical assistance and service write or call your nearest GDC representative.

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A SALES DIVISION OF

GENERAL ANILINE & FILM CORPORATION

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Heliogen Viridine 66-6001 manufactured by General Aniline & Film Corporation is sold outside the United States and Canada under the trade name Fenalac Viridine Y by distributors all over the world.

FEMCO

AUTOMATIC TRIMMER

FOR MOLDED GOODS

SEE FOR YOURSELF!...

...The remarkable job this machine does trimming all types of molded rubber goods

FEMCO's Standard Automatic Trimmer is the fastest, easiest and safest mechanical method of trimming molded rubber goods available today. Every 10 seconds — or less on some applications — this machine will trim an entire sheet of molded parts right from the mold. It will do it around the clock, day in and day out, with a minimum of maintenance.

Trimming is done by a traversing steel roll that compresses stock against steel rule cutting dies. This method of line contact cutting — exclusive with FEMCO — gives more lineal inches of usable die area than is possible with any other trimming device of comparable price.

Illustrated here are some of the many, many different molded rubber products now being trimmed on FEMCO's Standard Automatic Trimmer. Figure how many pieces you're trimming now and compare it to what the Standard Automatic Trimmer is doing. You'll readily see how this machine can cut your costs and increase your profits.

1. Crutch Tip
   144 cavity die; 20,000 per hour
2. Brake Cylinder Cup
   219 cavity die; 29,500 per hour
3. Brake Cylinder Boot
   100 cavity die; 10,000 per hour
4. Brake Cylinder Boot
   221 cavity die; 16,000 per hour
5. Golf Ball Center
   324 cavity die; 40,000 per hour
6. Bumper Washer
   192 cavity die; 8,000 per hour
7. Emergency Brake Pedal
   81 cavity die; 10,500 per hour
8. Toy Wheel
   81 cavity die; 10,000 per hour
9. Baby Bottle Nipple
   221 cavity die; 21,000 per hour
10. Door Stop
    30 cavity die; 7,000 per hour
11. Tire Boot
    84 cavity die; 20,000 per hour
12. Pan Scraper
    24 cavity die; 3,000 per hour
13. Gasket
    12 cavity die; 1,200 per hour
14. Gas Pedal Pad
    25 cavity die; 3,700 per hour
15. Power Brake Pedal
    36 cavity die; 4,800 per hour
16. Gasket
    14 cavity die; 1,800 per hour
17. Brake Pedal
    36 cavity die; 4,800 per hour

1917 43rd YEAR OF SERVICE 1960

The FALLS ENGINEERING AND MACHINE CO.

CUYAHOGA FALLS, O.

IF YOU'RE DIE CUTTING OR TRIMMING PARTS FROM ROLL STOCK MATERIAL, YOU'LL BE INTERESTED IN FEMCO'S ROLLER DIE CUTTER WITH AUTOMATIC FEEDER ATTACHMENT. IT'S DESIGNED ESPECIALLY TO HANDLE TOUGH, HARD-TO-FEED ROLL STOCK. FULL COLOR, SOUND MOVIES OF ALL FEMCO MACHINES ARE AVAILABLE FOR YOUR VIEWING ANY TIME. LET US KNOW WHEN AND WHERE YOU WOULD LIKE TO SEE THEM.

Panel members of the "Dispersion of Pigments and Chemicals" seminar, which was held on February 13. Left to right: *Moderator*, Rosswell C. Whitmore (Better Monkey Grip); *Speakers*, Dr. Isaac Drogin (United Carbon); Dr. A. I. Medalia (Godfrey L. Cabot); and C. P. Mullen (Gates Rubber).

Southern Rubber Group Holds Interesting Panel Discussions

► Two seminars, one on "New Polymers" and the other on "Dispersion of Pigments and Chemicals," at which five papers were presented, made up the technical program at the February 12 and 13 meeting of the Southern Rubber Group which was held at the Shamrock Hilton Hotel in Houston, Texas. The two-day meeting was attended by 248 members. The "New Polymers" seminar, moderated by Quentin Trahon (Firestone), was held on the afternoon of February 12, and consisted of the following papers: "Shell Isoprene Rubber and Its Vulcanizates," by F. W. Hannsgen (Shell Chemical), and "Advancing Technology in Butyls," by Win C. Smith (Enjay). The seminar on "Dispersion of Pigments and Chemicals," moderated by Rosswell C. Whitmore (Better Monkey Grip), consisted of three papers: "Incorporation and Dispersion of Ingredients in Rubber," by Dr. Isaac Drogin (United Carbon); "Determination of the Dispersion of Carbon Black in Rubber," by Dr. A. I. Medalia (Godfrey L. Cabot); and "Significance of Good Dispersion," by Carl P. Mullen (Gates Rubber).

The first seminar's speaker, Mr. Hannsgen, briefly reviewed the developments of the synthetic rubber industry. In addition, he gave a short analysis of the economic and supply and demand relationships as a basis for explaining the current activity in the field of isotactic polymers.

In outlining the physical properties and handling characteristics of polyisoprene, Mr. Hannsgen stated that, in general, processing and compounding procedures are similar to natural rubber. He pointed out that certain simple variations, dependent upon the type of stock being made and the equipment being used, help to achieve optimum properties.

The next speaker, Mr. Smith, in his discussion on butyls, remarked that it has often been said that butyl has better than average heat resistance, and, with the quinoid cure, has outstanding resistance in addition to good dynamic flexing. The speaker pointed out that there was some contentment with compression set values at room temperature, but values at 212°F. left something to be desired. Mr. Smith informed the group that recent work with new cure combinations and materials and the development of the new chlorobutyl, MD-551, has led to marked improvements under all these headings.

During his presentation, Mr. Smith discussed such cure systems as the sulfur donor system, the low sulfur and high accelerations vulcanizate system, resin cures, zinc oxide cure, diamine cure, quinoid cure, cure with polyhydroxy aromatics, cures with methylol resin and bromo resin, dithiols, ethylene trithiocarbonate, and ethylene thiourea.

Participants of the "New Polymers" seminar, which was held on February 12 as part of a two-day technical meeting of the Southern Rubber Group. Left to right: *Moderator*, Quentin Trahon (Firestone); Speakers, Win C. Smith (Enjay) and F. W. Hannsgen (Shell Chemical)

Discusses Dispersion

The first speaker at the second seminar, Dr. Drogin, stated that in considering the subject of incorporation and dispersion of ingredients in rubber, we must first take into account the finished product and the raw materials, i.e., the rubber and compounding ingredients involved, their physical and chemical properties, type of mixing equipment employed, processing techniques used, the degree of dispersion required in the final product, and whether or not achieving optimum dispersion is necessary and the cost warranted.

He explained that the extent of dispersion sought will depend upon the final products produced. In mats, he stated, dispersion is not a factor; while in tires, good dispersion is deemed essential. On the other hand, in certain industrial rubber products, such as engraving gums, rubber covered rolls, aircraft hydraulic hose, i.d.-o.d. tubing, weather stripping, etc., a higher degree of dispersion than that obtained in tire manufacture is prerequisite to meet desired standards.

Dr. Medalia, the second speaker, stated that carbon black consists of individual primary particles which are joined together in aggregates of varying sizes. He explained that we distinguish between so-called primary aggregates, in which the individual particles are permanently joined by sharing a crystal face, and the so-called secondary aggregates, which are simply a loose association of primary aggregates held together by attractive forces on the surface of the black.

The speaker informed the group that the tendency of the black to form secondary aggregates is the basis for the process of pelletizing, which is the last step in the manufacture of the black. He remarked that in this step the black is simply agitated, either wet or dry, and it spontaneously forms pellets which are particularly convenient for shipping and for dust-free handling.

The final speaker, Mr. Mullin, stated that to the rubber compounder, dispersion or degree of dispersion denotes the extent to which the individual particles of a pigment or compounding ingredient are moistened by, and covered with the rubber or polymer. He emphasized that the role of various compounding and processing factors is of utmost importance to control and for obtaining good or adequate dispersion.

He pointed out that dispersion is essential to provide abrasion resistance, flex life, weathering and product appearance. In addition, he remarked, it must be kept in mind that the ultimate properties and product requirements must be balanced always against product manufacturing economics.

Catalin Expands Capacity

► Catalin Corporation of America has completed an expansion of facilities to produce antioxidants designed to increase production by 40 per cent and raise capacity to about 6 million pounds per year. Improved production efficiency and extra assurances of maintaining high product purity were also part of the program. Principal products in which the company has boosted production are 2,6-ditertiary - butyl - para-cresol, which Catalin sells as CAO-1, and butylated hydroxy toluene, which the firm markets as CAO-3. CAO-1 is used as a beneficial additive in rubber, aircraft and automotive gasoline, jet fuel, and various other types of oil and petroleum products.

H. B. Warner

Heads Goodrich Chemical

► Harry B. Warner has been named president of the B. F. Goodrich Chemical Co., Cleveland, Ohio, succeeding John R. Hoover, who retired April 30 after 35 years with the company. Thomas B. Nantz, formerly vice-president, manufacturing, succeeds Mr. Warner as vice-president, marketing, and Robert D. Scott, formerly vice-president, development, becomes vice-president, manufacturing and development. Mr. Warner graduated from Ohio State University with degrees in chemistry and chemical engineering. He has been with Goodrich since 1939, and has also served as vice-president, development, of Goodrich Chemical, and in various manufacturing, engineering and field assignments in the United States and overseas.

Buys National Shoe

► American Biltrite Rubber Co., Inc., Trenton, N. J., has bought virtually all the capital stock and assumed the outstanding obligations of the National Shoe Products Corp., Framingham, Mass. National Shoe Products, said to be the country's largest distributor of shoe supplies, was acquired in a cash transaction, according to Maurice J. Bernstein, president of American Biltrite. Mr. Bernstein indicated that National will be operated as a subsidiary with the present management continuing. National Shoe Products handles over 100 lines of shoe supply products, and plans are being made to expand the company's distribution through broader coverage, an increased number of lines and additional warehouses to better serve the trade.

Cis-4 Discussed At SORG Meeting

► A review of the processing and physical properties of *Cis-4* polybutadiene and blends with natural rubber was given by Henry E. Railsback (Phillips Chemical) at the Spring Technical Meeting of the Southern Ohio Rubber Group on March 24 at the Gibbons Hotel, Dayton, Ohio. In his talk, "Compounding *Cis-4* Polybutadiene," Mr. Railsback remarked that the outstanding abrasion resistance and excellent hysteresis properties displayed by polybutadiene of high *cis-* configuration, has attracted widespread interest. He pointed out to the group that very early in the work with this rubber, it was observed that a transition in milling behavior occurs with a change in the temperature of the stock.

Mr. Railsback explained that easy processing compounds of excellent quality are obtained by blending *Cis-4* polybutadiene with other polymers such as natural rubber, and the blend stocks do not require special compounding to obtain acceptable processing. According to the speaker, the use of premasticated natural rubber, although not absolutely necessary, appears advisable.

Hycar Acrylic Latex

► Full-scale production of Hycar 2671, a reactive acrylic latex designed for use as a finishing agent in the textile and other industries, started April 1 at the Louisville, Ky., plant of the B. F. Goodrich Chemical Co. Development quantities of the latex have proved suitable in such applications as backings for upholstery and drapery fabrics, binder for non-woven fabrics, and as an adhesive or laminating agent.

Solvent dry cleaning and washing problems, the new latex gives nonwovens properties making them practical for apparel, at the same time simplifying the compounding, reducing processing costs, and increasing the stability of the nonwovens, it is said. In field tests Hycar 2671 overcame problems of using adhesives for assembling apparel, and stiffness of seams and discoloration were eliminated. When used as a paper saturant the product shows strong resistance to heat and light aging, while leather finishing compounds containing Hycar 2671 can give leathers outstanding resistance to cracking, according to the company.

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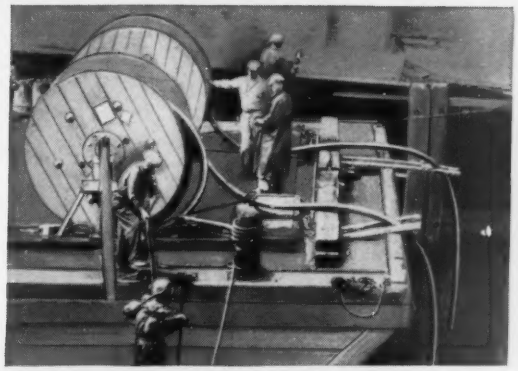

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Akron Group Holds Retreading Symposium

► "Retreading and Repairing of Tires" was the subject of the symposium at the spring meeting of the Akron Rubber Group, which was held on April 8 at the Sheraton Hotel in Akron, Ohio. Over 500 persons attended the symposium at which four papers were presented: "Introduction to Retreading and Repairing of Tires," by J. W. Hodgson (Firestone); "Production of Tread Rubber and Repair Materials," by Edwin T. Brodie (Goodrich); "Retread Shop Practices," by Charles M. Hofmann (General Tire); and "Equipment for Retreading," by Charles R. Schlegel (Branick Mfg.). Richard R. Sawdey (Firestone) served as symposium moderator.

The newly-elected 1960-1961 group officers were introduced at a dinner following the symposium. The officers are: *Chairman*, Irvin J. Sjothun (Firestone); *Vice-Chairman*, John H. Gifford (Witco); *Treasurer*, B. N. Larsen (Naugatuck Chemical); and *Secretary*, R. B. Knill (Goodyear).

Guest speaker at the dinner was Dr. H. Walter Grote, who discussed "Grotesques of the Mind." Dr. Grote substituted for "Wild Bill" Alexander, who was killed in an airplane crash on the Sunday preceding the meeting.

Cites Sales Factor

The first speaker at the symposium was Mr. Hodgson, and he remarked that the time is not far off when the sale of retread tires will equal the sale of new replacement tires. In explaining why the retreading industry, at present selling one retread tire for every two new tires sold, will experience this boom, Mr. Hodgson stated that it is economically unsound to throw away the 70 per cent investment in the cord body of a tire merely because the tread is worn out. The smart thing to do is to retread the tire at a savings of 50 to 60 per cent of the cost of a new tire.

According to the speaker, it is estimated that in 1960, the industry will retread 31,500,000 passenger tires and 7,930,000 truck tires. The latter figure, Mr. Hodgson reported, means that for every 10 new truck tires sold, there will be nine retread truck tires sold.

Mr. Brodie, the second speaker in the symposium, discussed tread rubber and tread rubber cushion gum; repair materials used in retreading; repair materials used in sectional repairs; and special purpose repair materials. He remarked that repair and retread compounds differ in general from tire compounds in that some must remain uncured for as long as two to three years in storage.

The speaker told the group that the two most important items in terms of volume are tread rubbers and the fast growing chemical cure methods of repair. With good workmanship and high quality materials, tires can be repaired and retreaded to give safe, long wearing usage, he stated.

The third symposium speaker, Mr. Hofmann, stated that, unfortunately, some people consider the recapped tire as merely a second hand article whose useful life is limited. He explained that retreads actually have some attractive advantages over new tires, such as absence of body growth which has already occurred.

Mr. Hofmann pointed out the premium quality tread rubber can be applied to deliver greater mileage than the original, and of greatest importance, the attractive low cost of providing a vehicle with four new retreads. This can easily be accomplished by faithful conformance to such proper shop practices as inspection, drying, buffing, cementing, application of cap and splicing, curing, and finishing.

The final symposium speaker, Mr. Schlegel, presented a 30-minute, color, sound movie entitled "Tire Tempo." In introducing the film, he remarked that part of the movie goes back to the good old days of the tire repair industry. He informed the group that the retreading industry has grown to a point where it is doing almost one billion dollars worth of business a year. He explained that there are over 75 billion cars on the highways and this figure is increasing every year. The growth of the retreading industry in the past ten years has been fabulous, according to the speaker, and yet it is far from reaching its potential. At the conclusion of the symposium, pre-submitted questions were answered by the speakers.

"Retreading and Repairing of Tires" was the subject of a symposium held on April 8 by the Akron Rubber Group. The panelists were, left to right: standing, R. R. Sawdey (Firestone), moderator; Charles R. Schlegel (Branick Mfg.); seated, J. H. Hodgson (Firestone); Edwin T. Brodie (Goodrich); and Charles M. Hofmann (General Tire).

Goodyear Expansion Plans

► A 1960 world-wide capital expenditure program of $90 million, largest in the company's history and exceeding 1959 expenditures by nearly $35 million, has been planned by Goodyear Tire & Rubber Co., Akron, Ohio. The current investment plan will bring to a total of $440 million the Goodyear 1955-1960 capital investment expenditures. In making the announcement, E. J. Thomas, chairman of the board, said that construction of new production facilities as well as the expansion and modernization of existing ones, both foreign and domestic, will be included in the 1960 capital expenditures. The program will touch almost all areas of Goodyear activities.

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Columbian Announces Neotex Carbon Blacks

► Columbian Carbon Co., New York, N. Y., has announced the availability of three new carbon blacks which, while falling into the fineness range common to HAF, ISAF and SAF blacks, possess lowered structure. This permits the new blacks to develop normal modulus in compounded elastomers while also permitting lowered hardness.

One of the new blacks, Neotex 100, is an oil furnace carbon black in the HAF fineness range with lowered carbon structure. This carbon black develops normal modulus as opposed to high modulus characteristic of oil furnace blacks, the company states. Neotex 100 is said to produce compounded properties comparable to channel black. However, its cure rate is similar to other furnace carbon blacks. Where channel blacks are used, Neotex 100 will find applications. Specifically, it can be used to develop tensile, modulus and elongation properties similar to channel carbons. It is designed for use in such products as carcass stocks, off-the-road tire treads and high grade mechanical goods.

New Oil Furnace Black

Another of the new blacks, Neotex 130, is an oil furnace black in the ISAF range with lowered carbon structure. This black also produces normal modulus. Neotex 130 develops good tensiles, normal modulus, high elongation and lower Shore hardness. These properties may be utilized in passenger treads to obtain improved ride and low noise while maintaining a good wear level.

Neotex 130 may also be used to replace some usage of ISAF and channel to obtain improved properties in natural rubber truck and passenger tire applications. The lowered structure property of Neotex 130 makes this black somewhat difficult to disperse in synthetic polymers, the company states. Best dispersion of Neotex 130 can be obtained through the black rubber approach.

The third new black, Neotex 150, is an oil furnace black in the SAF fineness range with lowered carbon structure. This, too, develops normal modulus. Neotex 150 produces the highest tensiles of all available rubber carbon blacks, Columbian Carbon declares. It makes possible normal modulus, high elongations and lower Shore hardness compounds. These properties may be utilized in passenger treads to obtain the best combination of ride, low noise and tread wear.

Columbian Carbon notes that Neotex 150 does not lend itself to factory dry mixing procedures. Fineness of particle size and lower structure characteristics of this carbon black make it necessary to handle it through the black rubber process to achieve a satisfactory level of dispersion.

A. C. Rowley

B. A. van Arkel

Two Appointments at Vanderbilt

► The R. T. Vanderbilt Co., Inc., New York, N. Y. has announced the promotion of Arthur C. Rowley to the post of assistant director of the company's laboratory in East Norwalk, Conn. Also, Bernard van Arkel has joined the Vanderbilt technical sales staff and has been assigned to the territory formerly covered by Mr. Rowley.

Witco Plans English Unit

► Plans for the construction of a synthetic rubber latex plant in the Midlands of England have been announced by Witco Chemical Company Ltd., London, England, wholly owned English subsidiary of Witco Chemical Co., Inc. The plant, to be located on a 20-acre site, will have an initial annual capacity of 8 million pounds dry weight and will produce a complete line of butadiene-styrene, high styrene, nitrile and other acrylic types of latices.

RCSA Officers Take Posts

► Officers of the Rubber Chemical Salesmen's Association of Akron took their posts at a recent association meeting. Officers for 1960 are: *President,* John Shrontz (Harwick Standard); *Vice-President,* Warwick McCutcheon (J. M. Huber); *Secretary,* Laurence Pieroth (Naugatuck Chemical); and *Treasurer,* William Bowers (Midwest Rubber Reclaiming). Committee chairmen are: Program, Gilbert Gingold (Sid Richardson Carbon); Social, M. E. Noah (C. P. Hall), and Publicity, Ernest Puskas (Thiokol).

Future meetings of the association are scheduled to be held on March 25, April 29, May 27, September 30, October 28 and November 25. Meetings held to date featured a program, conducted by Gilbert Gingold, consisting of a showing of the Dartnell Corp. film entitled, "Developing Your Sales Personality." At an earlier meeting, W. M. Rich of Henry J. Clayman & Associates spoke on the topic of "The Human Aspects of Advertising."

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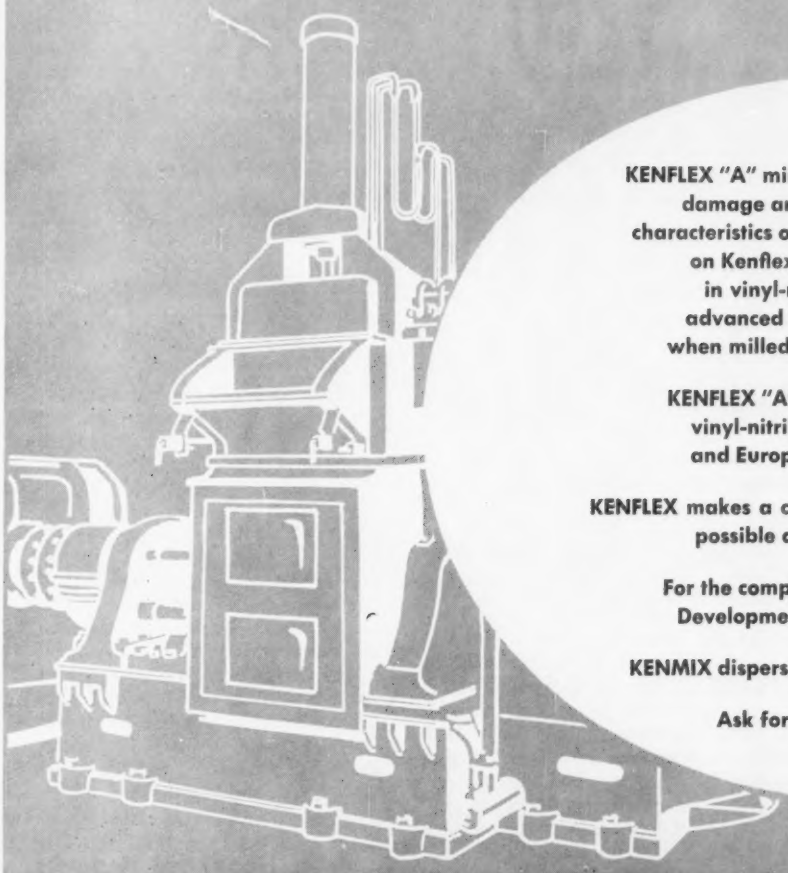

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New Plants in France

► Two new synthetic rubber manufacturers are expected to raise next year's French production of synthetic rubber to 80,000 tons annually, an amount which should exceed domestic needs by about 20,000 tons. The two new manufacturers behind the expected production rise, four times present capacity, are Societé l'Electrochimie Ugine and Societé des Elastomeres de Syntheses. Societé d'Electrochimie was to have opened a plant in April at Villiers - Saint - Sepulcre, and Societé des Elastomeres, a Shell affiliate, will start producing next year at Berre. Until now the only synthetic rubber producer in France has been Societé Socabu at Port Jerome near Le Havre.

At the Ugine plant, hot and cold nitrile rubber will be produced in addition to latex and butadiene-styrene type rubber. Production in the first year is expected to be 7,000 tons, with 12,000 tons produced annually thereafter. Societé des Elastomeres will produce butadiene-styrene type rubber, with an initial capacity of 50,000 tons a year. Later it will produce 70,000 tons a year. Actual production next year, however, will be 15,000 tons, and in 1962, about 60,000 tons. The company will use butadiene derived from refinery gas butane in producing its rubber. During the first few years of operation the butadiene will be imported from the United States. Later it will be prepared by the company from the gas of the nearby Shell oil refinery.

Firestone Promotions Set

► Tire Engineering and Development Department of the Firestone Tire & Rubber Co., Akron, Ohio, has announced seven promotions including that of T. A. Robertson, former manager of tire engineering, who has been appointed manager of tire engineering and development. R. P. Powers has been promoted to manager of tire testing and advanced engineering; R. H. Finefrock, to sales engineer; C. T. Reynolds to manager of mileage tire development; J. H. Cox to manager of fleet and commercial testing; L. L. Baldwin to manager of sales engineering, truck tires; D. A. Clendenen to manager of manufacturers sales engineering; and E. W. Mitchell to senior compounder, steel cord and mileage tires.

J. L. Talley

Named to Falls Sales Post

► J. L. Talley has been named midwest sales representative by the Falls Engineering and Machine Co. of Cuyahoga Falls, Ohio, and will represent the company in Illinois, Wisconsin, Indiana and Iowa in the roller die cutter and splitting machine lines. Mr. Talley spent eleven years with Goodyear Tire and Rubber Co., Akron, Ohio, and was in the service three and one-half years. In 1952 he joined the French Oil Machinery Co. of Piqua, Ohio, later establishing his own company in Chicago, Ill., as a manufacturers' representative. He is a member of the Chicago Rubber Group.

Union Carbide Addition

► A new process development building has been completed at the Long Reach, West Va., plant of the Silicones Division of Union Carbide Corp. Process development activities, previously located at the division's laboratory in Tonawanda, N. Y., have been transferred to Long Reach. The new building, 155 by 66 feet, contains equipment for both batch and continuous processes, high pressure experimentation, reactions and distillation of products encountered in the processing of chlorosilanes, the various polymers and end products. It also contains semi-works scale equipment for scale-up studies and the preparation of intermediate quantities of new materials for market exploration. C. W. Rehm, formerly process development manager, has become superintendent of production at the plant. He is succeeded by Dr. R. F. Kayser.

U. S. Rubber Cited

► For the second consecutive year, employees of U. S. Rubber Co., New York, N. Y., led the rubber industry in setting safety records. The company's world-wide 1.32 rate of accidents per million man-hours worked in 1959 represented a 50 per cent improvement over the previous year's record. According to National Safety Council figures, the rate of accidents per million man-hours worked is 6.17 for all industry and 2.81 for rubber companies. Domestic plants of U. S. Rubber scored a 1.14 mark. The company employs more than 49,000 people performing nearly 100 million man-hours of work in 54 domestic, Canadian and overseas plants. U. S. Rubber also led with the most favorable accident severity record. During 1959 employees lost only 150 days per million man-hours worked on a world-wide basis, compared to a rubber industry average of 387 days lost, and a general industry average of 744. For the second time in the past three years there were no working fatalities.

Chemetron Issues License

► Vulcan Artefatos de Borracha S.A., Rio de Janeiro, Brazil, is the twelfth overseas company to be licensed to produce vinyl foam by the elastomer process, and the first South American company to be licensed. The announcement was made by the Girdler Process Equipment Division of Chemetron Corp., Louisville, Ky., exclusive overseas licensor of the process. Vulcan Artefatos de Borracha S.A., which pioneered the latex foam business on a large scale in Brazil, is an associate of Vulcan Material Plastico S.A., largest South American producer of vinyl laminates. Overseas elastomer process licensees are also located in Italy, England, Australia, France, Belgium, Germany, Sweden, Finland, Spain, and Japan.

Print Neoprene Reports

► The Elastomer Chemicals Department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has assembled the articles on neoprene wire and cable, which have appeared in its "Elastomers Notebook" over the past several years, in an illustrated 16-page brochure. The compilation contains 14 articles which describe the performance of neoprene wires and cables.

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W. L. Loving

Elected Vice-President

► William L. Loving, Godfrey L. Cabot, Inc., Boston, Mass., has been elected a vice-president of the parent company and placed in charge of carbon black research, technical service, and domestic production. For the past five years in charge of carbon black production in the Southwest for Cabot Carbon Co., he will now be located in Boston. Before assuming his new post he had been a vice-president and general manager of the Carbon Black Department of Cabot Carbon since 1955, rising from the post of executive assistant to become general manager. He originally joined Cabot in 1930, associated with the Southwestern operations at Pampa, Texas, and became director of the Southwestern Research and Development Department in 1940.

Canfield Buys Equipment

► The manufacturing facilities of Monroe Auto Equipment, Monroe, Mich., have been purchased for an undisclosed price by H. O. Canfield Co., Bridgeport, Conn., manufacturer of molded, extruded, and rubber-to-metal components for industry. The purchase will make it possible for Canfield to expand into the fields of rubber and metal bushings and other rubber products requiring the use of automatic injection type presses. The company plans to move all the equipment of the Monroe plant to its plant at Clifton Forge, Va., where its own rubber operations are concentrated. The Monroe plant is in Hillsdale, Mich.

Firestone Expanding

► Production facilities of the Firestone Tire & Rubber Co. are being expanded by a $120 million construction and modernization program. Five new plants are under construction. Tire plants are being built in Calgary, Alberta, Canada, and Bethune, France. Synthetic rubber plants will be constructed in Port Jerome, France, and Bareilly, India, and a new plant for the production of Coral and Diene synthetic rubbers will be completed this year in Orange, Texas. Other new facilities are being built for the manufacture of synthetic fibers and polypropylene at the company's plant in Hopewell, Va.

Expansion and modernization programs under way at all North American tire plants are scheduled to be completed this year. Other facilities in this country scheduled for expansion are the Pottstown plastics plants; steel products plants in Akron and Wyandotte, Mich.; the Electric Wheel Co., a Firestone division in Quincy, Ill.; synthetic rubber plants in Akron and Lake Charles, La.; and the World Bestos Corp., New Castle, Ind., a Firestone division.

Foreign plants to be expanded and modernized are those in: Brentford, England; Buenos Aires, Argentina; Sao Paulo, Brazil; and Valencia, Venezuela.

Rubber Division Booklets

► The Rubber Division Library has mimeographed and made available copies of four bibliographies. They are: No. 8, Part I, "Diaphragms—Rubber and Elastomer Materials, Revised," compiled in October, 1959, and containing 195 references; No. 25, "Diisocyanate Compounds," Supplement I, "Polyurethane Elastomers," compiled in January, 1960, and containing 389 references; No. 25, "Diisocyanate Compounds," Supplement II, "Polyurethane Foams," compiled in January, 1960, and containing 461 references; and No. 30, "Friction of Rubber," compiled in October, 1959, and containing 83 references. The cost is $5.00 each, except to members of the Division of Rubber Chemistry, ACS, who will be charged $2.50. The bibliographies can be ordered from: Rubber Division Library, University of Akron, Akron 4, Ohio. Checks should be made payable to the American Chemical Society, Division of Rubber Chemistry.

J. M. Flounders

Joins American Biltrite

► James M. Flounders has been appointed vice-president in charge of Research and Development of the Boston Woven Hose & Rubber Division of American Biltrite Rubber Co., Inc., Cambridge, Mass. A graduate of the University of Delaware, he attended Northwestern University Institute of Management. Starting in the Technical Department of Electric Hose and Rubber Co., he then transferred to the Technical Department of B. F. Goodrich, Akron, Ohio, where he became sales manager of all hose, and most recently, director of new product development for the B. F. Goodrich Industrial Products Co. He succeeds Norman J. Cyphers, who has resigned.

Bulletin Improvements

► A large number of alterations and additions have been made beginning with the February issue of the *Rubber Statistical Bulletin*, published by the Secretariat of the International Rubber Study Group, London, England, and distributed in the United States by RUBBER AGE, 101 West 31st St., New York, N. Y. Added information deals mainly with synthetic rubber, but some alterations have also been made in the sections dealing with natural rubber, including planted acreages, and with reclaimed rubber. Additional information on synthetic rubber includes: export data by months and years for West Germany, France, Italy, and the United Kingdom; export data by destinations for West Germany, Italy, and the United Kingdom, and an extension of the production table.

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Names in the News

L. A. Frese has retired as an assistant comptroller of Firestone Tire and Rubber Co., Akron, Ohio.

L. L. Scott, formerly on the raw material sales staff at Thalco Chemical, has been appointed sales engineer at Western Backing Corp., Culver City, Calif.

R. P. Dinsmore, vice-president in charge of research and development at Goodyear Tire and Rubber Co., has been elected a director of the company. His election to the board fills a vacancy resulting from the recent death of Kenneth A. Spencer.

Leon W. Miller, assistant and consultant to the executive vice-president, Plastics and Coal Chemicals Division, Allied Chemical Corp., retired April 1 after spending his entire business life of 44 years at Allied.

Grover C. Clark, formerly supervisor of tire merchandising, has been named to the newly created post of manager of tire merchandising at Chemstrand Corp.

Karl O. Nygaard has been appointed manager of wholesale staff in replacement tire sales of B. F. Goodrich Tire Co. He was formerly corporate director of business research.

Perce C. Rowe, a vice-president of the U. S. Rubber Co., has been elected a director of Congoleum-Nairn, Inc.

Tuure Tenander and **Malcolm McVickar** have been named vice-presidents in charge of sales at the Converting Paper Division and the Duplicating Papers Division, respectively, of Crocker, Burbank Papers, Inc.

Dr. George A. Gillies has joined the Emeryville Research Center staff of Shell Development Co. as a chemist in the Plastics and Resins Department. He was formerly a research chemist for DuPont.

Ralph Erickson, vice-president of sales, Texas Butadiene and Chemical Corp., has been named chairman of the Broker Group for the American Red Cross campaign in Greater New York.

Charles H. Sommer has been elected president of Monsanto Chemical Co. and **Charles Allen Thomas** has been elected chairman of the board of directors.

Theodore V. Busk, advertising manager of Farrel-Birmingham Co., Inc., has retired, after serving with the company since 1916.

Roger L. Steller has been named eastern field sales manager of Hycar special purpose rubber at B. F. Goodrich Chemical Co., with sales management responsibility for all East Coast states, Tennessee and Alabama.

Charles E. Jones, who was employed at the Seiberling Rubber plant even before F. A. Seiberling purchased it in 1921, has retired as a vice-president and comptroller of the Seiberling Rubber Co.

William S. Edgerly, head of the company's Financial Department, has been elected assistant treasurer of Godfrey L. Cabot, Inc.

Fred C. Hands, former plant manager of Goodrich-Gulf's synthetic rubber plant in Institute, W. Va., has been appointed director of procurement for Goodrich-Gulf Chemicals, Inc.

Kenneth E. Ward, company secretary of United Clay Mines Corp., has retired after a thirty year association with the company.

R. T. Budd has been named manager of the New Delhi, India, plant of Goodyear Tire & Rubber Co., and **A. W. Hubinger** has been appointed personnel manager of the India plant.

Dr. Henry E. Haxo has been named senior research scientist at Wayne, N. J., research center of U. S. Rubber Co.

Dr. R. F. Fischer, research supervisor at the Emeryville, Calif., research center of Shell Development Co., has been named technical assistant for chemicals to the president of Shell Chemical Co., New York, N. Y.

John B. Henrich has been elected a director of National Lead Co., New York, N. Y., succeeding **James A. Taylor,** who has retired after 47 years with the company.

Tires Shown at Auto Show

► Five tire manufacturers, Dunlop, Esso, Metzeler, Michelin, and Pirelli, displayed their tires at the Fourth International Automobile Show, which was held on April 16 to 24 at the New York Coliseum, New York City. Over 250,000 persons attended the nine-day show and viewed 311 automobile models, representing the products of 86 car manufacturers, at exhibits housed in more than 250,000 square feet of space on four floors of the Coliseum.

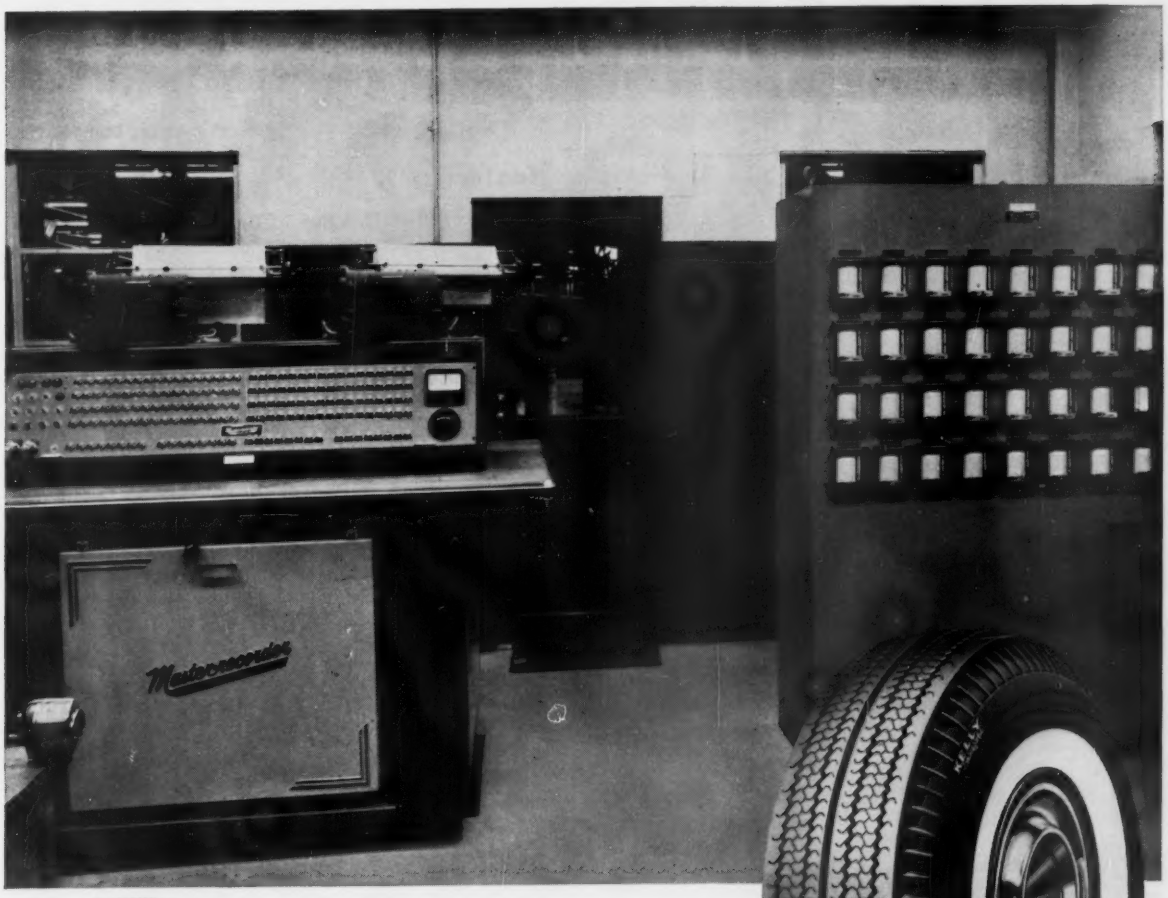
Making its debut at the show was Pirelli's BS 3 tire, said to be a completely new concept in tire making. The BS 3 is an automobile tire with a three-band replaceable tread. Treads may be substituted without the necessity of purchasing a new tire. (RUBBER AGE, Nov. 1959, p. 286). Also displayed at the Pirelli exhibit were its regular line of sports car tires.

Dunlop premiered a new type of lightweight, compact spare tire assembly. Known as the Dunlop Standby tire, it consists of a steel disc, drilled to match the wheel studs of the car, carrying a narrow-section tubeless tire. The tire is not inflated until required, at which time a CO_2 bottle supplied with the unit provides the necessary pressure. Conventional inflating equipment can also be used. The entire deflated unit is less than one-inch thick. Dunlop also displayed its new steel-reinforced Duraband tire.

Esso displayed its new Bucron tire, as well as its complete line of automotive equipment and accessories. Michelin featured its steel cord tire, the Michelin X. This tire consists of three layers of steel cords which brace the tread. Casing cords are laid archwise instead of crisscross to reduce lateral distortion and increase vertical flexibility. Four types of sports car tires were shown by Columbia Motor Corp., New York, N. Y., distributor of Metzeler tires. The tires displayed were the Cinturato, a low profile type tire; S2 sport and touring tire; S3 extra super sport; and a mud and snow tire.

Martin Adds Fender Flaps

► Martin Rubber Co., Inc., Long Branch, N. J., has announced its entry into the bicycle fender flap field, and is offering six models, with or without jewels. Samples and quotations may be obtained from the company.



KELLY Springfield TIRES **BUILDS QUALITY...**

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Pictured is the new Taylor Master-recorder* System, in use with McNeil Automatic Loading Bag-O-Matic presses at The Kelly-Springfield Tire Company's Cumberland, Md., plant.

The first of its kind to be used in the industry, the Master-recorder System helps insure uniform quality by detecting minute variations in the vulcanizing temperatures that might affect tire quality. It automatically checks each of 68 presses and 8 headers every six minutes. Should the temperature exceed or fall below that prescribed, an alarm is sounded and a signal light appears on the console, identifying the press or header. (See scanning and logging system at left of photograph). Off-normal conditions are typed in red on logging chart. The panel of Taylor TRANSET* miniature recorders on the right logs the actual bag pressure and cure cycle time. This provides a chart record of the curing cycle for the future reference of operators and quality control men.

With this centralized information system, rejects are kept to an absolute minimum and operator time is reduced. Since any malfunction can be detected almost immediately, the maintenance problem is greatly simplified.

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The Master-recorder System is a product of Taylor-Emmett Controls, Inc., a subsidiary of Taylor Instrument Companies.

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Financial News

U.S. Rubber Reclaiming

► For 1959: Net earnings of $557,-204, which are equal to $1.25 per share, compared with $301,210, or 67c per share in 1958. Net sales in 1959 totaled $7,057,227, against $5,224,793 in the previous year. The company reported sales of $7,057,-225 in 1959; 35 per cent greater than 1958 sales. It credited high earnings of 1959 partly to increased activity in the automobile industry, partly to increased operating efficiency stemming from a plant consolidation and modernization program completed in 1957, and predicts that continuing operating efficiency will offset higher costs.

Witco Chemical

► For 1959: Net income amounted to $2,028,200, or $2.66 per share of common stock, compared with $1,-638,000, equal to $2.44 per share for the 1958 fiscal year. In 1958, 41c per share was realized from a special non-recurring item of $272,900 so that net income from all sources in 1958 totalled $1,911,200, or $2.85 per share. Net sales in 1959 amounted to $51,567,400, compared with the 1958 figure of $39,942,700.

Union Asbestos

► For 1959: Net income after taxes amounted to $121,288, equal to 25c per share of common stock, compared with a loss of $236,046 in 1958. Net sales for the 1959 fiscal year totaled $10,199,512, compared with 1958 sales of $9,047,160.

Whitney Blake

► Year ended December 31: Net income amounted to $200,513, equal to 93c per share, compared with a net loss of $183,133 in 1958. Net sales for the year totaled $10,945,-818, compared to $8,202,667 in 1958.

Hewitt-Robins

► For 1959: Net loss in 1959 of $148,504, compared with a net profit of $898,281 in 1958. Net sales in 1959 totaled $46,612,625, compared with $49,031,220 in the previous year.

Sheller Manufacturing

► For 1959: Net income after taxes of $1,237,474, or $1.30 per share, compared to a net loss of $304,371 in 1958. Net sales for 1959 amounted to $42,938,183, against the 1958 figure of $30,166,617. In pointing to the growth of its non-automotive business, the company credited the expanded uses of polyurethane foams by the furniture industry and other fields. For the fourth quarter of 1959 the quarterly dividend on common stock was increased from 20c per share to 25c. The company reports a strong financial position with net working capital amounting to $10,838,154.

Baldwin Rubber

► Six months ended December 31: Net income amounted to $81,367, equal to common share earnings of 19c, compared with $72,146, or 17c per share, for the like period a year ago. Net sales for the six-month period totaled $8,870,328, compared with $7,382,532 for the same six month period last year.

Allen Industries

► For 1959: Net income after taxes amounted to $2,152,780, equal to $2.25 per share of common stock, compared with $870,858, or $1.03 per share which includes payment of a 25 per cent stock dividend last year. Net sales totaled $43,169,066, compared with the 1958 figure of $33,814,078.

McNeil Machine

► Year ended December 31: Net income amounted to $3,531,432, equal to earnings of $2.84 per share, compared with a net income of $2,045,965, or $1.58 in 1958. Net sales for the year totaled $38,-132,832, compared to $31,172,778 in 1958.

Industrial Rayon

► For 1959: Net income after taxes of $839,000, equal to 45c per share of common stock, compared to a loss of $3,058,000 in 1958. Net sales for 1959 totaled $62,068,000, against $47,852,000 in 1958.

National Rubber Mach'y

► For 1959: Net income after federal and state taxes of $395,622, equal to $1.88 per share, compared with a loss of $146,523 in 1958. Net sales for last year totaled $12,661,-747, against 1958 net sales of $8,-249,809. The report to the stockholders of the company stressed the backlog of approximately $12 million in orders with which the company ended the year. Total volume of orders received in 1959 exceeded $22 million, double the amount received in any previous year.

Dresser Industries

► Quarter ended January 31: Net income after taxes amounted to $2,-221,347, equal to common share earnings of 47c, compared with $1,-793,095, or 38c per share last year. Sales and revenues for the quarter totaled $56,711,842, compared with $50,777,223 a year ago.

Mohawk Rubber

► For 1959: Net earnings after taxes amounted to $1,219,347, equal to $2.48 per share of common stock, compared with $1,065,375, or $2.16 per share for the 1958 fiscal year. Net sales totaled $31,656,632, compared with the 1958 figure of $25,-513,203.

Farrel-Birmingham

► For 1959: Net income after taxes amounted to $1,338,893, equal to common share earnings of $4.18, compared with $1,401,268, or $4.38 per share for the previous year. Net sales for 1959 totaled $37,592,767, compared with the year ago figure of $35,525,530.

Amerace

► For 1959: Net income of $2,-168,847, which is equal to $3.39 a common share, compared with $2,-022,324, or $3.06 a share in 1958. Sales in 1959 were $55,268,572, against $45,268,751 in the previous year.

New Jersey Zinc

► For 1959: Consolidated net earnings of $3,474,222, equal to $1.77 per share, compared to $798,292, or 41c per share in 1958. Net sales for 1959 were $18,290,508, contrasted with $13,096,332 in the previous year.

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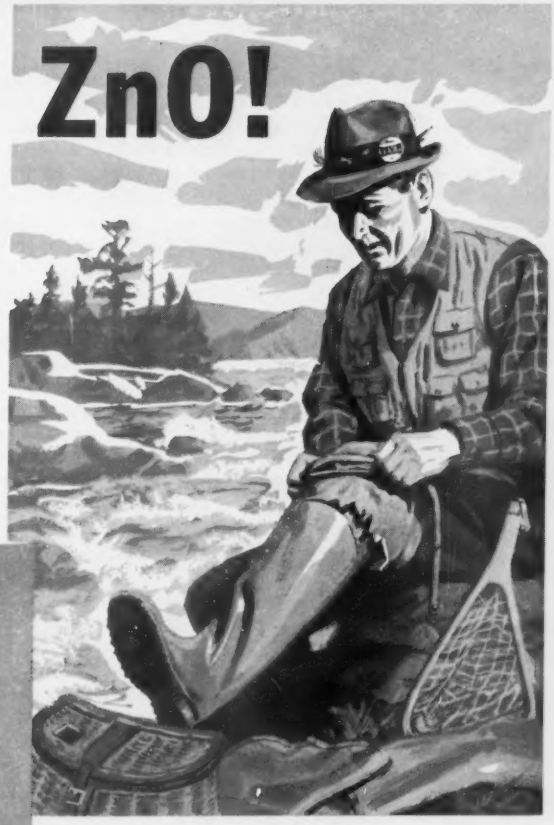

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West Coast News

► Nine papers will be presented at the first annual TLARGI Foundation Technical Conference, to be held June 1 and 2 at the Mayfair Hotel in Los Angeles, Calif. The Los Angeles Rubber Group conference will consist of two technical sessions, the first on the afternoon of June 1, and the second on the morning of June 2. The nine papers to be presented are: "The Rotomill, A Continuous Mixing Device," by Arthur E. Juve, B. F. Goodrich Co., Akron, Ohio, and R. H. Kline, National Rubber Machinery Co., Akron, Ohio; "Silicone Rubber—Today and Tomorrow," by P. C. Servais and K. E. Polmantier, Dow Corning Corp., Midland, Mich.; "World-Wide Developments in Tire Production," by C. A. Litzler, C. A. Litzler Co., Cleveland, Ohio.

Also, "A Towing Device for Estimating Road Wear," by L. P. Collins and E. B. Storey, Copolymer Corp., Ltd., Baton Rouge, La.; "Latex Masterbatching, Compounding Developments, Future Possibilities and Influence on Rubber Manufacture," by Isaac Drogin, United Carbon Co., New York, N. Y., "A Practical Method of Classifying All Elastomeric Vulcanizates," by N. L. Catton, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., R. C. Edwards, Chrysler Engineering, Detroit, Mich., and T. M. Loring, Precision Molded Co.; "Contrast in Response of Elastomers to High Temperature Vulcanization," by F. B. Smith, Naugatuck Chemical Co., Naugatuck, Conn.; "Compounding *Cis*-polybutadiene," by H. E. Railsback, C. C. Biard, and J. R. Haws, Phillips Petroleum Co., Bartlesville, Okla.; and "*Cis*-Trans Isomerization in Natural Polyisoprenes," by Dr. J. I. Cunneen, British Rubber Producers Association, London, England.

The authors, with the exception of Dr. Cunneen, will present their own papers. His will be presented by Ralph F. Wolf (Natural Rubber Bureau). The papers were selected from a group presented before the International Rubber Conference last November. Future papers will be chosen from those presented at the recent meeting of the Division of the Rubber Chemistry. The conference registration fee of $5 will admit registrants to both sessions.

► The technical meetings of the Los Angeles Rubber Group held on April 5 and March 1 at the Hotel Biltmore in Los Angeles, Calif., were addressed by F. W. Wilcox and Robert Sullivan, respectively. Mr. Wilcox (Witco Chemical) spoke on "Value of Ozone Tests for Estimating Durability of Rubber Products," while Mr. Sullivan (Shell Chemical) spoke on "Polyisoprene Rubber."

Mr. Wilcox stressed the problem constituted by the cracking of rubber products when exposed to weather or ozone. When rubber under stress is exposed outdoors, it often does not follow a normal aging cycle, he said, and its weathering characteristics are therefore highly unpredictable. Factors such as ultra violet light, extremes in temperature and atmospheric gasses, particularly ozone, are directly or indirectly responsible for its erratic behavior. Since these factors vary with location and season, the true weather aging properties of a rubber compound are necessarily determined by long term exposure, preferably under actual service conditions.

He went on to discuss a faster testing method, in which the rubber specimen is exposed to ozone at a controlled temperature, usually 100° F. He stated that wide discrepancies often exist between the accelerated ozone test and actual outdoor exposure. The accelerated test as now run, he said, is of questionable value for estimating the outdoor durability of natural rubber or butadiene - styrene compounds that depend on wax or combinations of wax and antiozonant for protection. In conclusion, lack of correlation appears to be mainly due to the inability of this ozone test, performed in a limited set of test conditions, to duplicate outdoor weathering with its wide variations, he said.

Mr. Sullivan, in his speech on polyisoprene rubber, said that Shell Isoprene Rubber, the first commercial scale production of a "synthetic natural" of the *cis* 1,4 polyisoprene type, has many of the desirable properties of Hevea. Since the supply of Hevea is expected to be less than demand, the synthetic *cis* 1,4 polyisoprene polymers are of great interest at this time. Going on to discuss production of Shell Isoprene Rubber, Mr. Sullivan pointed out that there are certain differences which can influence the results obtained. In open mill mixing, he said, temperature should reach 150 to 170° F. to achieve optimum dispersion of sulfur and accelerator. In Banbury mixing better black dispersion and superior extrusion properties are obtained if chemical plasticizer is added with the polymer and the mixing temperature raised to 200° F. before addition of the black and other ingredients.

Properties of vulcanizates approach those which are customarily obtained with natural rubber, he continued. Hardness, heat buildup and resilience are essentially equal; tensile strength, modulus and tear resistance are somewhat lower than with Hevea. Mold flow is superior resulting in excellent detailing which in turn reduces rejects from mold defects or permits more intricate shapes. Similarly white color, uniformity and lack of contamination are valuable features found in synthetic polyisoprene. In summarizing, he stressed that there is a broad range of applications where Shell Isoprene Rubber is useful.

► The newly formed Rubber Section of the Greater Los Angeles Chapter of the National Safety Council presented a panel discussion at the Seventh Annual Western Safety Congress, held April 11 through 13 at the Ambassador Hotel. Speakers and their topics were: Wade C. Ruble, personnel manager, B. F. Goodrich Company, Los Angeles, "Safety Contests and Their Value as Employee Incentives"; Floyd W. Burgner, safety director, Firestone Tire and Rubber Co., Los Angeles, "Workmen's Compensation Laws in California"; Warren J. Durkin, plant manager, Lee-Tex Rubber Products Corp. of California, Los Angeles; "Hazard Control in the Rubber Latex Industry"; and Paul Jenican, personnel manager, Stauffer Chemical Co., Los Angeles, "Hazard Control in the Moulded Rubber Goods Industry."

► Polyfoam Products Co., Los Angeles, Calif., has purchased a new plant at 651 Rio St., Los Angeles, Calif., and the company will move to its new 25,000 square foot building about June 1. Polyfoam, manufacturer of decorator pillows, sleeping pillows and mattress pads, and distributor and converter of polyurethane foam, plans to add many new items in an expansion program.

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Canadian News

► The 1959 annual report of Polymer Corp., Ltd., Sarnia, Ontario, showed net earnings after income tax provision at $3,690,000, equal to $1.84 per share, a decrease from 1958 reflecting a three-and-a-half months plant shutdown during a strike. Gross and net incomes after taxes were ahead of 1958 for the period not directly affected by the strike and startup. Regular dividends of $1.50 per share, totaling $3 million, were paid. Capital expenditures on new plant totalled $2,703,000. Included in the capital program during the year were two new additions: a pilot plant for extension of the new synthetic rubber development program, and a warehouse in Sarnia for improving handling of rubber inventory and service to customers.

Polymer's research program is directed mainly towards: the general area of new polymers made by stereospecific systems; the reduction of manufacturing costs and improvement of the intermediate products, isobutylene, butadiene and styrene; and the diversification of butyl, butadiene-styrene and latex products by the introduction of modified and improved forms of these materials.

► Mailman Corp., Ltd., Montreal, Quebec, is purchasing Kiorflex Plastics, Ltd., Brampton, Ontario, manufacturers of rain and winter plastics footwear, from B. F. Goodrich Canada, Ltd., Kitchener, Ontario, at an undisclosed price. The transaction was announced jointly by R. V. Yohe, president of Goodrich, and A. S. McLean, president of British Rubber Co., Ltd., Montreal, Quebec, a company owned by Mailman. Mr. Yohe said the high style requirements of the footwear lines do not blend with the rubber and chemical activities of the company and could be handled better by a specialist footwear organization. Mr. McLean said Koroseal and Koroflex branded footwear will continue to be manufactured from vinyl resins supplied by Goodrich, and distribution will continue through the same channels.

► A new type of rubber expansion joint between slabs of concrete, designed to eliminate rhythmic road shock which drivers encounter on super-highways, is slated for Canadian highway installations. According to M. E. Bailey, general manager, industrial products division, B. F. Goodrich Canada, Ltd., Kitchener, Ontario, the new product permits as much as three inches of expansion and contraction, while still keeping the rubber flush with the highway. He added that warm summer days and zero winter extremes would have no detracting effect on the performance of the expansion joint. Made in sets which extend completely across each lane of a dual highway, the 13-inch wide joints are anchored in the concrete for water-tight sealing. The expansion joint will also be adapted for bridges, bridge approaches, normal highways, and airport runways, Mr. Bailey predicted.

► The first tire to be manufactured in Western Canada, produced at the new Firestone Tire & Rubber Co. plant in Calgary, Alberta, was presented to the mayor of Calgary in a ceremony at the city hall, by Firestone President T. M. Mayberry. The tire was produced in the plant to test the installation of the machinery, although full production is not scheduled to get under way until August. According to Mr. Mayberry, the plant will be equipped with the most advanced tire building and curing machines in North America.

► The Rubber Association of Canada has moved its offices to 212 King Street West, Toronto, Ontario. The telephone number remains EMpire 4-3207.

New Tyrex Cord Tires

► A complete new line of passenger tires, made with Tyrex viscose cord, has been introduced by the McCreary Tire & Rubber Co., Indiana, Penna. The new line was adopted to satisfy the increasingly demanding needs of modern driving and transportation. The viscose cord used in the tires is said to provide longer, safer mileage because of its outstanding ability to resist the road shock and impact. The viscose cord's extra durability makes repeated retreading possible, the company states.

Cable Company Formed

► A new company, United States Underseas Cable Corp., has been formed as a joint venture of three other companies, to design and construct long distance underwater cable systems. The parent companies are the Phelps Dodge Corp.; Northrop Corp. and its subsidiary Page Communications Engineers, Inc.; and Felten & Guilleaume Carlswerk Aktiengesellschaft of Cologne, West Germany. The new company will have access to the West German company's manufacturing facilities for underseas cable as well as other technical facilities.

Phelps Dodge, in addition to its widespread copper interests, is a major supplier of electronic cable and is the American manufacturer of Styroflex cable, developed by Felten & Guilleaume. Northrop is a producer of military aircraft and electronic equipment, and Page designs and builds long-range communications systems. Felten & Guilleaume. has pioneered technological developments in the engineering, manufacturing and laying of submarine cables.

Main offices of United States Underseas Cable will be in New York and Washington. Howard T. Brinton, president of Phelps Dodge Copper Products Corp., will also be president of the new company. Herbert H. Schenck, former vice-president of engineering at Page, will be executive vice-president and general manager.

Develops Economy Tire

► The development of an economy-priced nylon tire has been announced by Firestone Tire & Rubber Co., Akron, Ohio. According to Earl B. Hathaway, vice-president in charge of sales, this new replacement tire, called the Firestone Champion Nylon, will offer a greater degree of tire safety to the economy-minded tire buyer. Nylon, pound for pound, is stronger than steel, and its added strength allows for faster and cooler operation in tires, an important safety factor for the motoring public, Mr. Hathaway states. The new tire will be manufactured in both black and white sidewalls in the same popular rim sizes as its rayon counterpart, 6.70, 7.10, 7.60-15-inch and 6.00-16-inch plus a new size, 7.50-14-inch for 1957 and more recent automobiles, the company states.

RUBBER TRENDS

by The Economist Intelligence Unit, Ltd.

RUBBER TRENDS is a quarterly bulletin for all those concerned with rubber, whether as a manufacturer, dealer or producer. The bulletin provides regular analysis of the main factors affecting the supply and consumption of both natural and synthetic rubber. **It does not duplicate information already available elsewhere; the emphasis throughout is on long term studies of rubber trends.**

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Obituaries

Harold D. Tompkins

► Harold D. Tompkins, vice-president on special assignment for the Firestone Tire & Rubber Co., Akron, Ohio, died in his sleep April 17 at a hotel in Boston, Mass. He was 66 years old. Mr. Tompkins was vice-president in charge of trade sales at Firestone from 1941 to 1957. In 1940, he was appointed sales manager for the company in Akron, after serving as sales manager in California since 1935. From 1925 to 1935 he was manager of truck tire sales for the company's West Coast Division in Los Angeles, Calif., after joining Firestone in 1919 as a general line salesman, and rising to the post of manager of truck tire sales in the Seattle, Wash. district in 1922.

Mr. Tompkins was chairman of the Inter-Industry Safety Committee from 1956 to 1958 and had served on the committee since it was founded in 1946. The committee works for organized support of young and adult driver education and vehicle-safety checks. He was a member of the Akron City Club, Portage Country Club, Mayfield Country Club of Cleveland, the Jonathan Club of Los Angeles, Thunderbird Country Club of Palm Springs, Calif., the Akron Chamber of Commerce and the Union Club of Cleveland.

Fred C. Theiss

► Fred C. Theiss, former head of the Technical Service Department of the Akron plant of General Tire and Rubber Co., Akron, Ohio, and one of the first chemists to investigate the use of synthetic rubber for commercial purposes, died April 5 in City Hospital, Akron. He was 70 years old. At the time of his retirement in 1955 he was a chemist for Sun Rubber Co., Barberton, Ohio. He graduated from Buchtel College, now the University of Akron, in 1910, and holds a master's degree in science, also from Buchtel. He was associated with the Miller Rubber Co., Seiberling Rubber Co., RCA Rubber Co., all located in Akron, and Master Tire & Rubber Co. In 1934 he began his association with General Tire working on the German synthetic rubber, Buna. He is survived by his wife, and a sister.

Charles P. Hall

► Charles P. Hall, a leader in the chemical manufacturing industry and president of several firms in the field, died April 17 at his home in Akron, Ohio. He was 71. Mr. Hall was president of the C. P. Hall Co., Akron, Ohio, and the C. P. Hall Co. of California; chairman of the board of the C. P. Hall Co. of Illinois; president of the Halon Chemical Co. of New York, and president of the General Investment Co. in Akron. In 1920 Mr. Hall left the Firestone Tire & Rubber Co., Akron, to organize the C. P. Hall Co. which first acted as a manufacturer's agent in selling chemicals and later began manufacturing its own chemicals used in industrial processing.

He was a member of the Portage Country Club in Akron, the Chemists Club of New York City, N. Y., and the Chicago Athletic Association. He was also active in Masonic organizations. He is survived by his wife, a daughter, two sons, eight grandchildren, and a brother.

Edward P. Coxhead

► Edward P. Coxhead, operator of his own company, the E. P. Coxhead Co., Oakland, Calif., died January 20. He was 61 years old. Before acquiring his own company, Mr. Coxhead was vice-president in charge of sales at Pioneer Rubber Mills, San Francisco, Calif., where he was employed for 35 years. Known in the mechanical rubber goods industry in both the Pacific Coast area and in the Middle West, he was instrumental in establishing the Midwest branch of Pioneer Rubber Mills in Chicago and was district manager there for a number of years. He is survived by his wife, his son, and his daughter.

Floyd Moody

► Floyd Moody, assistant purchasing agent for the National Rubber Machinery Co., Akron, Ohio, died suddenly March 23 at his home in Munroe Falls. He was 63 years old. He had been employed by the National Rubber Machinery Co. for more than 35 years. He is survived by a wife, two sons, and four grandchildren.

Thomas R. Benton

► Thomas Robert Benton, corporate staff director of Industrial Engineering and Industrial Relations of the plants of the Armstrong Rubber Co., West Haven, Conn., died on March 18 in New Haven, Conn., at the age of 49. He was a graduate of Lycoming College and received a master's degree in Industrial Engineering from Carnegie Institute of Technology. He began his career in the rubber industry as a supervisor in the U. S. Rubber Co. footwear plant, Williamsport, Penna., in 1932. In 1936, he became personnel manager at the Pennsylvania Rubber Co. in Jeannette, Penna. In 1939, he joined Armstrong as industrial engineer at the Natchez plant, subsequently becoming industrial relations manager at the Des Moines plant in 1943, and chief industrial engineer at the West Haven plant in 1949. He later became corporate staff director of industrial engineering and industrial relations over all of the Armstrong Rubber Co. plants, and, as a member of the staff, operated the Natchez plant in 1950 and 1951. He is survived by his wife and two daughters.

Charles T. Young

► Charles T. Young, former president of the Manhattan Securities Co., subsidiary of Raybestos-Manhattan, Passaic, N. J., died April 2 in the Suburban Nursing Home, Montclair, N. J. at the age of 90. Mr. Young was a vice-president and a director of the old Manhattan Rubber Co. when it was merged in 1929 with Raybestos. He then became factory manager for the merged concern at its Passaic plant. He was president of the Manhattan Securities Co. from 1946 until his retirement in 1953. He is survived by his wife, a daughter, a grandchild, and three great-grandchildren.

William F. Shore

► William F. Shore, president of the Shore Instrument and Manufacturing Co., Jamaica, N. Y., and holder of many patents for devices to test the hardness of rubber, died March 14 at his home in Freeport, L. I., N. Y. after a long illness. He was 76 years old. Mr. Shore founded the company, maker of laboratory instruments to test the physical properties of materials, in 1907. He is survived by his wife, a son, three daughters, a brother, and a sister.

FIRESTONE LATEX BUILDS A STIFFER HAND INTO CARPETS AND FOAM

A Firestone product-specialized FR-S® latex lends a hand to carpet backing, makes carpets stronger, longer lasting, more attractive and provides greater dimensional stability. This same versatile latex gives foam carpet backing extra stiffness per unit of weight as well as greater tear strength. It's Firestone FR-S 174, a styrene-butadiene resin latex. Put it to work for you by calling your latex compounder or a Firestone Technical Service Man. Write Firestone Synthetic Rubber & Latex Co., Dept. 23-5, Akron 1, Ohio.

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THE ORIGINAL...

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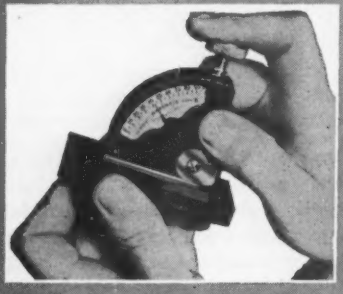

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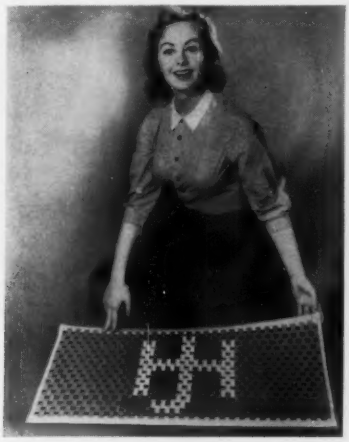
New Goods

Pawling Vinyl Plastic Mat

► A new rubber mat, called Parco Paragon, designed for maximum safety and easy maintenance, has been introduced by Pawling Rubber Corp., Pawling, N. Y. The mat, which can be reversed, contains flexible wiping blades that trap dirt efficiently. The company reports that since this mat is constructed without holes, even a woman with spiked heels is safe on its surface. Made of virgin



polyvinyl chloride compounds, the mat is said to have long life and color stability. It features 4 x 4-inch link sections which permit unusual checkerboard or solid color designs, and it can be rolled easily. The use of steel for reinforced nosings eliminates corner curling and protects the mat when being handled. The Parco Paragon mat is available in 11 colors; black, white, terra cotta, blue, dark green, light green, red, gray, yellow and orange. The mat is designed for use in homes, motels, hotels, restaurants, office buildings, schools, department stores, etc., the company states.

Electriduct Wiring System

► Electriduct, a custom wiring system made of rubber and designed to provide an over-the-floor wiring system with electrical outlets at various places in the middle of a room, has been introduced by the Electriduct Division of Ideas, Inc., Laramie, Wyo. A complete wiring system may be ordered by submitting a sketch showing where outlets are needed, or straight, standard lengths of the cord are available in 4, 5, 6, and 10 foot lengths. According to the company, Electriduct hugs the floor inconspicuously and is stumbleproof; equipment on casters rolls over it easily. The wiring system need only be placed on the floor and plugged into a wall outlet.

WIRE-IN-RUBBER

. . . problem solved

Since early 1930's, National-Standard has been the leader in the design and manufacture of tire bead equipment. Shown above is the latest in the continuing National-Standard product redesign and improvement program—the new Model PFB Pull-off and Festooner. This unit pulls wire from the let-off reels at a rate up to 1000 feet per minute through bead insulating heads, stores and continuously feeds the insulated wire to NS-designed bead machines. The new model features dual-speed control, new safety devices and a direct drive gear reducer, to improve efficiency and output for tire manufacturers.

This is another National-Standard contribution to the improvement of wire-in-rubber processing. Call National-Standard for help in solving your wire-in-rubber problems.

NS NATIONAL-STANDARD COMPANY

NATIONAL-STANDARD COMPANY
Niles, Michigan

In shoe sole stock

PANAREZ Resins deliver 5 big benefits

—without increasing costs

If you formulate shoe sole stocks, you can use one of these PANAREZ Hydrocarbon Resins as your softener and get five product quality and processing improvements—without increasing costs. Here are the benefits:

1) Better flex crack resistance
2) Improved color stability
3) Easy milling
4) Excellent mold flow
5) Easier dispersing of fillers

PANAREZ 3-210 is the suggested softener for white or light-colored stocks. In stocks where color is not as important, PANAREZ 7-210 and 8-210 are recommended.

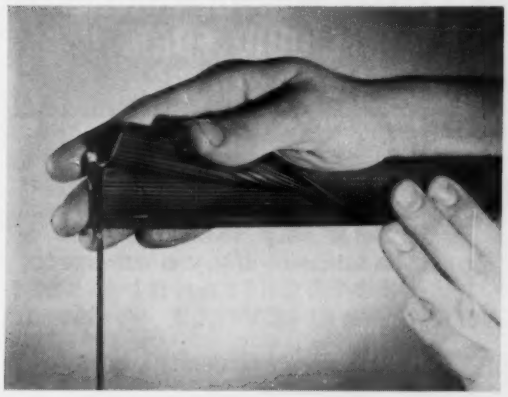
Amoco Bulletin F-2 gives full information about PANAREZ Resins in shoe sole formulations including comparative formulations and test results. Get a copy from your Amoco Chemicals representative.

AMOCO CHEMICALS CORPORATION
910 South Michigan Avenue,
Chicago 80, Illinois

AMOCO CHEMICALS

Firestone Climatite Gasketing

► Climatite, a new rubber gasketing and rubber stripping which acts as an anchor and cushion for large panes of glass and protects them from wind shock and vibration damage, has been introduced by Firestone Tire & Rubber Co., Akron, Ohio. Treated to resist weathering and deterioration, Climatite will seal out rain and cold and

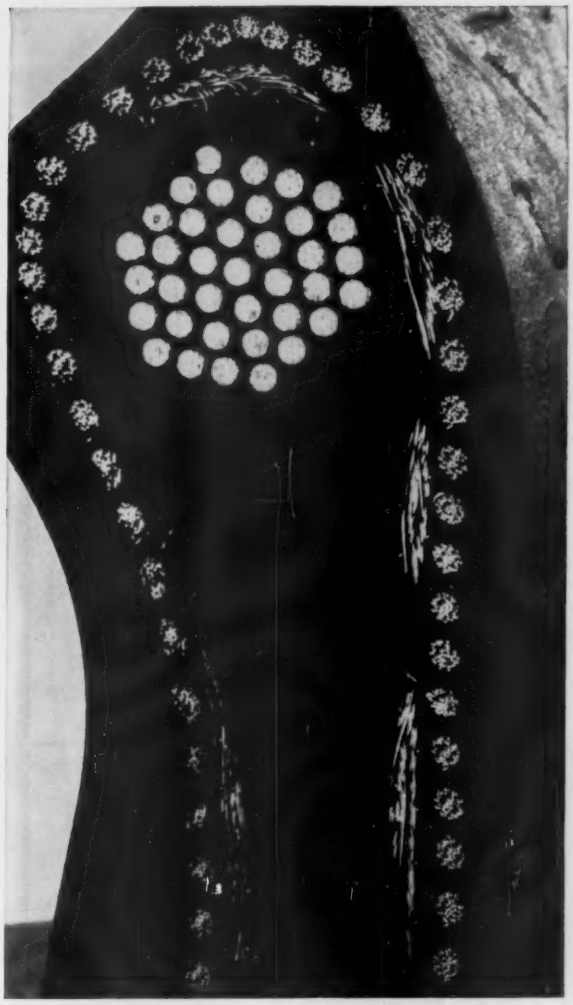


lock in heat. Compounded of special synthetic rubber, Climatite gasketing is extruded and then formed into perimeter gaskets with molded or vulcanized corners designed to fit the specifications of the architect or glazier. A custom product, it is offered in different shapes to conform to the design of the glass walls. The line includes an adhesive-backed rubber stripping designed for use with various glazing compounds.

Barr Nursery Rhyme Ball

► Nursery Rhyme Balls, each decorated with vividly colored nursery rhyme scenes, are being manufactured by Barr Rubber Products Co., Sandusky, Ohio. The rubber balls come in 4, 5, and

6 inch sizes, and are decorated with such nursery scenes as Humpty Dumpty, Mary and her little lamb, the cat and the fiddle, the cow who jumped over the moon, and Jack-Be-Nimble.



WIRE-IN-RUBBER

. . . problem solved

The hexagonal bead in the photo above is a new type of tire bead developed for use in single wire-ply tires where conventional square beads are not practical. Hexagonal bead grommets are already in metal-ply bus and truck tires now on road tests and under development.

The design and manufacture of a special bead-winding machine for producing a variety of bead-grommet cross sections is another National-Standard contribution to the rubber industry. It is typical of the many solutions to wire-in-rubber problems that have come from National-Standard engineers for over 50 years. Call National-Standard for help in solving your wire-in-rubber problems.

NS NATIONAL-STANDARD COMPANY

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Niles, Michigan

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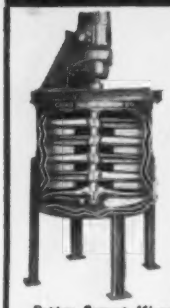
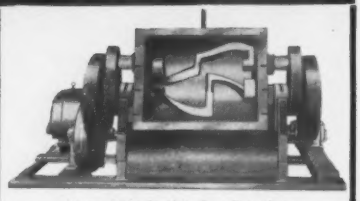
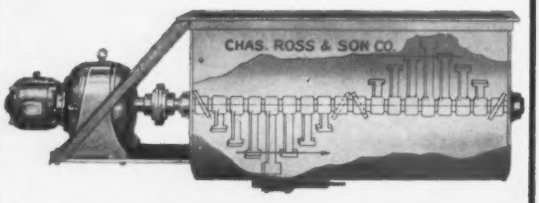


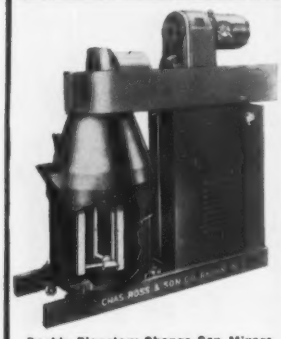
Rubber Cement Mixers
100 - 1000 Gal. Sizes



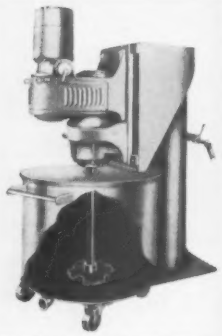
Heavy Duty Double Arm Kneaders
1 pint - 150 Gal. sizes

Rubber Reclaiming Mixers
100 - 1000 Gal. sizes



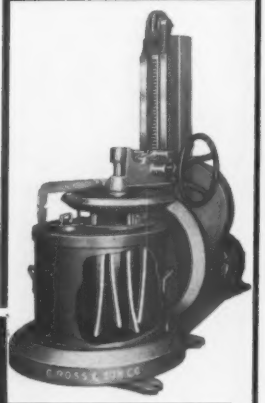


Double Planetary Change Can Mixers
1 - 150 Gal. sizes



High Speed Change Tank-Mixers
80 - 250 Gal. sizes

Heavy Duty Paste Mixers
25-1000 Gal. sizes



Heavy Duty Change Can Mixers
8 - 60 Gal. sizes

Also Dry Crushing and Pulverizing Mills, Three Roller Mills, Hopper Mills, High Speed Dissolvers or Dispersers, and Mixers of all types for Dry, Liquid, Paste and Heavy Paste Materials.

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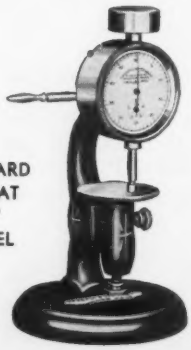

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ROLLS
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two Rolls
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26" DEEP THROAT MODEL

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U. S. Royal V-Belts

►U. S. Rubber Co., 1230 Ave. of the Americas, New York, N. Y., has introduced a new type of V-belt, said to have a 40 per cent horsepower rating increase over previous U. S. Rubber belts, at no increase in price. The stepped up rating of the new U. S. Royal V-belts eliminates the need for a premium belting line, the company states. Made by a new process, the cords of each belt are processed through a cord treatment machine designed by and custom-built under the direction of the company's Development Department.

Cords are normalized and impregnated with latex in every fiber and then built into the belts under tension with virtually error-proof electronic precision to ensure that each cord will pull its uniform share of any load. This results in higher drive capacity at less cost because fewer belts need be used and narrower sheaves are possible. Another new production method utilized is a molding technique through which inner or outer imperfections are eliminated, contributing to longer belt life and smoother-running performance. U. S. Rubber claims that this new molding process also increases wear resistance by converting the covers of the new line of belting into a homogeneous blend. The belts are available in all stock transmission widths and lengths.

Decorated Vinyl Balls

►Barr Rubber Co., Sandusky, Ohio, has added a sturdy vinyl ball with brilliant colors to its line of children's decorated balls. The new ball has brilliant blue and gold designs over a solid flame

base. The ball comes in three sizes, 4⅜, 5½ and 6½ inch diameters. The balls are being marketed in four sizes and shapes of floor displays, as well as in dozen packs.

Coveralls With Attached Boots

►Nylon coveralls with attached boots are being manufactured by M. Setlow & Son, Inc., 131 Chestnut St., New Haven, Conn. The garments are made from lint-free white nylon pack cloth and can also have gloves attached. The attached boot is formed by continuing the back panel of the leg until it meets the sole of the boot, and by shaping the front panel of the leg to form the front of the foot.

WIRE-IN-RUBBER

. . . problem solved

The polyethylene bead wire package shown above is another new development from National-Standard that permits more extended storage of bead wire without danger of rust or corrosion.

Extensive testing of the new package over many months in highly humid environmental chambers, without any evidence of wire corrosion, proved the new package superiority over old-style wrappers . . . means tire manufacturers can store bead wire for months without fear of damage.

The solution to this special wire-in-rubber problem is another National-Standard contribution to the rubber industry. Call National-Standard for help in solving your wire-in-rubber problems.

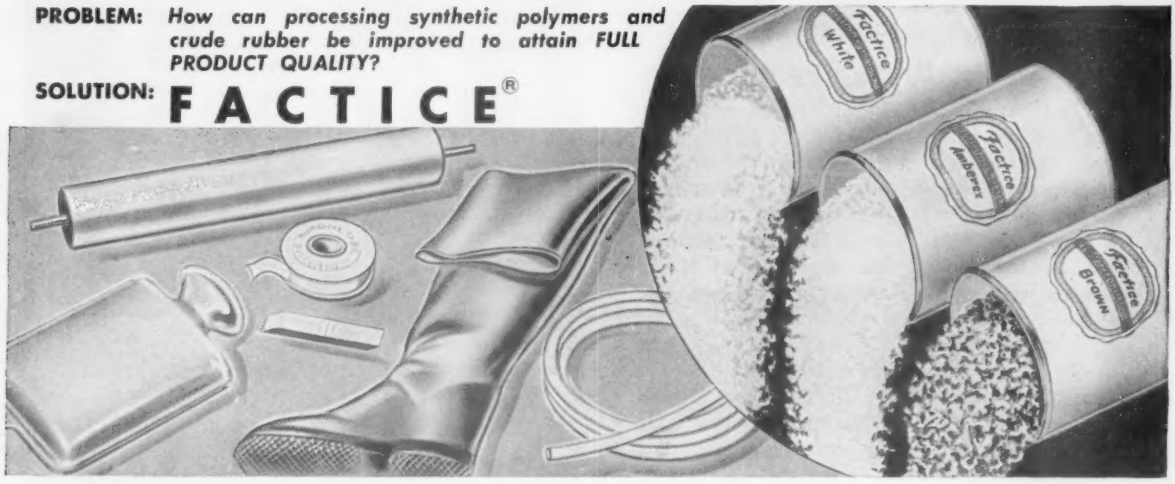
NS NATIONAL-STANDARD COMPANY

NATIONAL-STANDARD COMPANY

Niles, Michigan

PROBLEM: ***How can processing synthetic polymers and crude rubber be improved to attain FULL PRODUCT QUALITY?***

SOLUTION: **FACTICE®**



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Factice — THE STAMFORD RUBBER SUPPLY CO. — Vulcanized Oil

NOTE THESE OUTSTANDING QUALITIES: Rapid incorporation rate. Facilitates pigment dispersion. Prevents the sagging of extruded goods and stock contraction previous to cure. Dries out sticky compounds and prevents their adhering to mill and calender rolls. Improves low temperature flexibility. Prevents sweating where stocks are heavy in processing oils. Good aging qualities. Compatible with neoprene, crude, and SBR. FACTICE is supplied in white, amber and brown.

Feel free to submit your problems to us. Data on request any time.

The STAMFORD RUBBER SUPPLY CO.
Stamford, Conn.

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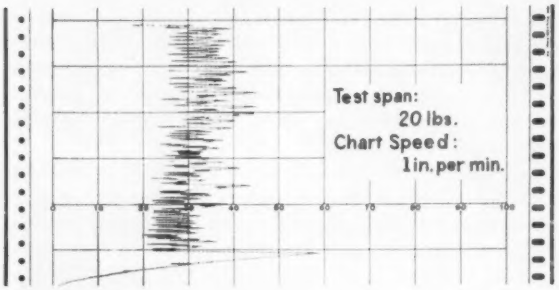
FROM THE SCOTT LABORATORY

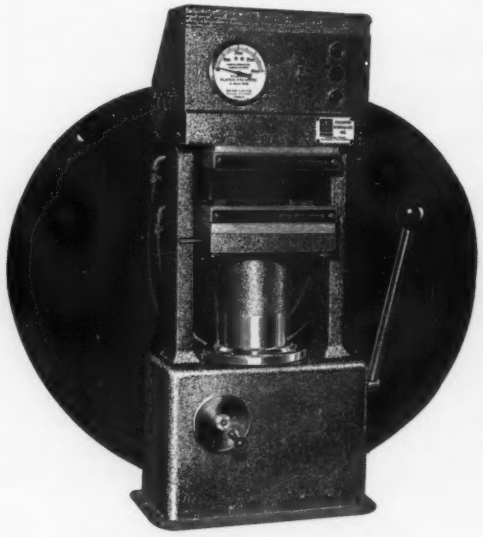
"PEEL" TEST FOR RUBBER HOSE

Adhesive bond of individual plies can be determined simply, precisely, economically with the Scott Model CRE electronic tester. As vulcanized hose sample rotates, rubber "peels" from fabric. Bond separation from each *individual yarn* can be registered for a complete "picturized" story of product quality. Test *your* rubber products with the versatile Model CRE. Write for CRE Brochure.



SCOTT TESTERS, INC., 85 Blackstone Street, Providence, R. I.

SCOTT TESTERS
THE SURE TEST... SCOTT!



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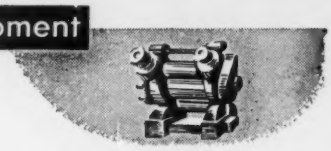
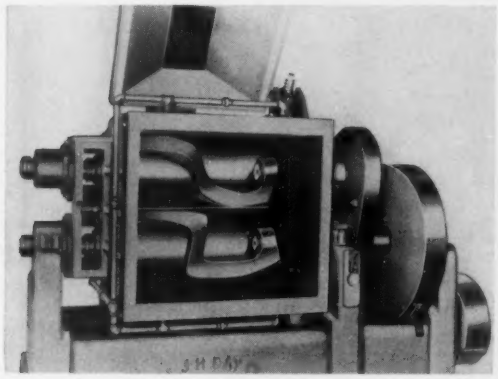


Day Double Arm Mixers

► Mogul mixers are designed primarily for heavy duty mixing and kneading of viscous fluids and semi-solids such as rubber cement, adhesives, lacquers, flushed colors, sealing compounds and plastics, states the manufacturer, J. H. Day Co., 4932 Beech St., Cincinnati 12, Ohio. According to Day, the mixers' heavy, rigid construction, over-



size bearings, sturdy drives and solid alloy steel agitator shafts ensure long life and reduce maintenance costs. Capacities of the Mogul mixers range from 2½ to 600 gallons. The small models mix experimental batches and small production quantities. They are designed to duplicate, in a test run, the exact characteristics encountered in production work using larger Mogul models, the company reports.

Miniature Polyurethane Foam Machine

► The Miniature Model small-shot polyurethane foam production unit, manufactured by Martin Sweets Co., Inc., 114 South First St., Louisville 2, Ky., is said to be capable of pumping, metering and mixing two-component formulations for rigid, semi-rigid, or flexible foams. The throughput is variable from zero to two pounds per minute. According to the manufacturer, with the self-cleaning, on-off mixing device, shots of mixed materials can be accurately proportioned, dispensed, and reproduced in quantities of a few grams to continuous pours. The unit is self-contained and includes: component tanks; temperature controlling heat exchanges and heated delivery hoses; individual throughput control of materials by positive type variable drives and rotary pumps; unique mixing head and foam cycle controls; and all of the basic elements required for any satisfactory foam producing installation, the company states. The unit measures 33 by 26 inches, with an overall height of 52 inches.

WIRE-IN-RUBBER

. . . problem solved

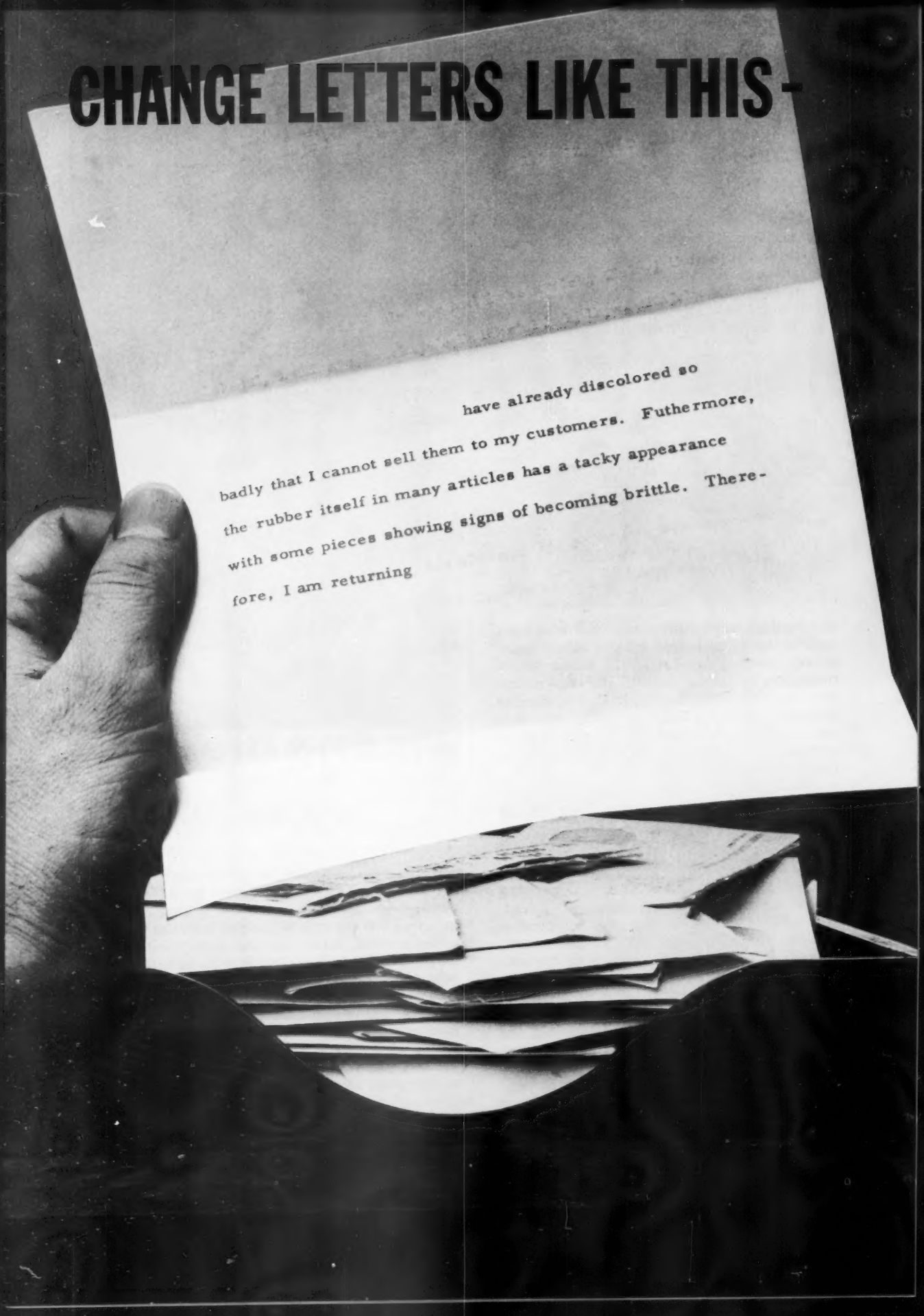
In the cross section of tire tread shown above, you see hundreds of tiny pieces of .006″ brass-plated, high-tensile, high-carbon steel wire. Cut to accurately measured lengths, the wire is molded into tire treads for added traction, better heat and static dissipation and longer life, for such applications as aircraft tires and other critical tire applications. The testing and manufacture of brass-plated, high-tensile wire with proper adhesion and strength was a National-Standard engineering contribution to the rubber industry. It is typical of the many National-Standard wire-in-rubber problem solutions. Call National-Standard for help in solving your wire-in-rubber problems.

NS NATIONAL-STANDARD COMPANY

NATIONAL-STANDARD COMPANY

Niles, Michigan

CHANGE LETTERS LIKE THIS-


have already discolored so
badly that I cannot sell them to my customers. Futhermore,
the rubber itself in many articles has a tacky appearance
with some pieces showing signs of becoming brittle. There-
fore, I am returning

TO LETTERS LIKE THIS-

WITH CYANAMID ANTIOXIDANTS

exposed to the heat and

light in my window all summer, were not even slightly dis-

colored or tacky. This is, by far, the best performance

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DRILLED-TYPE
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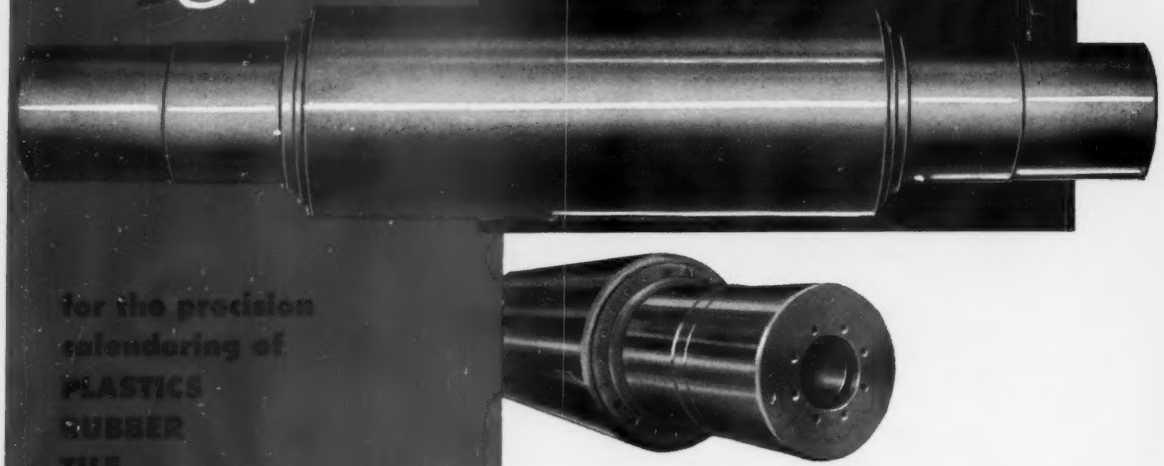

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PLASTICS
RUBBER
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or any materials requiring
close heat control

UNITED Precision Ground, DRILLED-TYPE ROLLS, the result of careful metallurgical control over raw materials, and of strict quality control in every phase of manufacture . . .

MAINTAIN A UNIFORM ROLL SURFACE TEMPERATURE throughout, with minimum deviation at any point.

ASSURE FULL RANGE HEATING and cooling over wide temperature ranges.

PROVIDE ACCURATE, QUICKLY RESPONSIVE TEMPERATURE CONTROL.

UTILIZE FULL ROLL FACE with new, ring closure type designs.

PERMIT ADJUSTMENT OF RING CLOSURE GASKET AND BOLTS, WITH ROLL IN PLACE in calender or mill, thus eliminating production downtime due to roll removal.

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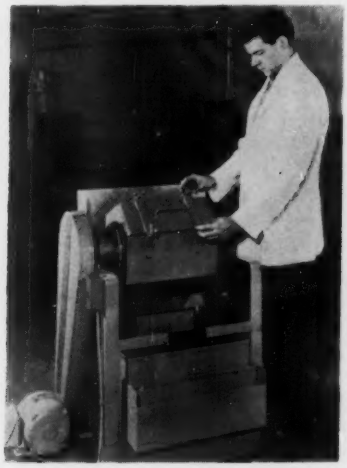
Barrel Finishing Unit

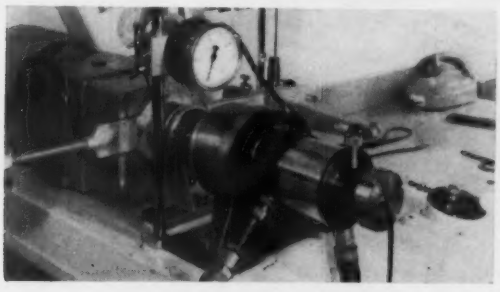
► Tumb-L-Matic Inc., St. Mary's St., Stamford Conn., has introduced a barrel finisher for deflashing plastic parts in either wet or dry process. Known as Model XL-1415, the unit is also said to be especially suited to deburring small metal stampings and castings, as well as to ball burnishing of jewelry parts. The hexagonal barrel is 14



inches in diameter, 15 inches long and lined with ¼-inch thick neoprene. Power is provided by a ¼ h.p. motor with a ⅝-inch pitch, guarded chain drive, and barrel speed adjustable from 15 to 45 rpm. A caster-mounted work and compound separation system contains a screen that retains work when the barrel is emptied, allowing media to be caught by another screen while water and compound pass through.

Plastograph Extruder Head

► C. W. Brabender Instruments, Inc., 50 E. Wesley St., South Monmouth, N. J., has developed a new extruder attachment for its Plastograph. According to the company, the new extruder head is the latest of a variety of interchangeable measuring heads for the instrument which measures and records the processability of



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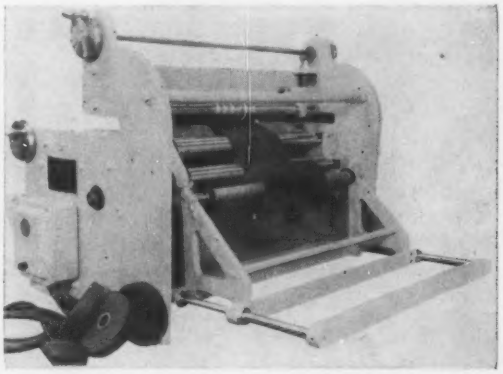
plastomers and elastomers. Originally designed to meet specific rubber test processing requirements, the head attachment is available with two screws and can be used, the manufacturer states, to measure the work and/or power required to extrude rubber or plastomers with similar properties. The jacket of the head can be maintained at any temperature up to 200°C.

Rubber Specimen Cutting Press

► The NAEF sample cutting press is designed for improved accuracy and lower cost in preparing rubber test specimens. The press, designated Model B, manufactured by SMS Instrument Co., P. O. Box 24, Rensselaer, N. Y., is also used to prepare plastic, textile, paper and leather test specimens. Dies for the press are to ASTM or customer specifications and are interchanged rapidly. Manually operated, a force of 80 pounds is exerted at the end of the arm for two tons ram pressure. Thin materials such as paper or textiles are cut up to 40 plies, and product and waste material are knocked out with each release of the press arm. The machine is 23 inches high, 15 inches wide, 16 inches deep, and weighs 85 pounds.

Rubber Slitter

► Doven Division of Appleton Machine Co., Appleton, Wisc., has developed a new rubber slitter for use in the slitting and rewinding of difficult materials such as solid and silicone rubber, heavy gage plastics, leather, etc. The unit, designated Model R-18 Rubber Slitter, will slit as nar-



row as ⅛ inch and can handle webs up to 18 inches wide, the company reports. In addition, polyurethane foam and sponge rubber up to 1 inch in thickness can also be handled on the slitter. Principal features of Model R-18 include control over stretch and distortion while slitting and the absence of fusing or interleaving while rewinding, the manufacturer states.

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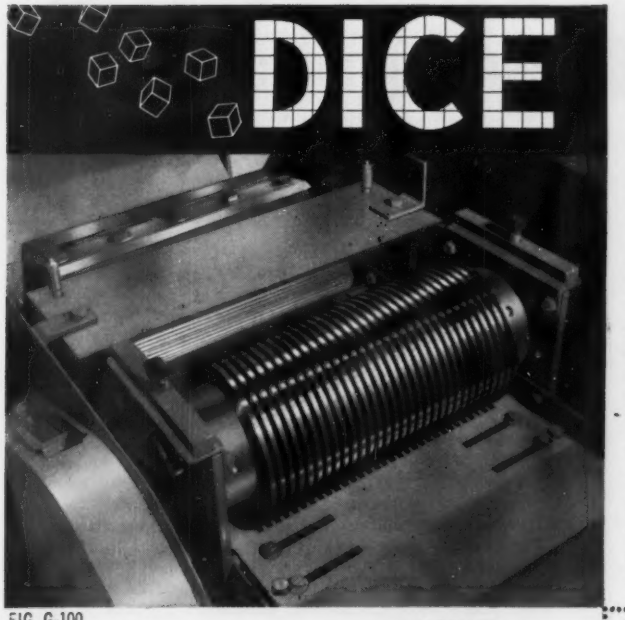

FIG. G-100

RUBBER AND PLASTICS WITH ACCURACY

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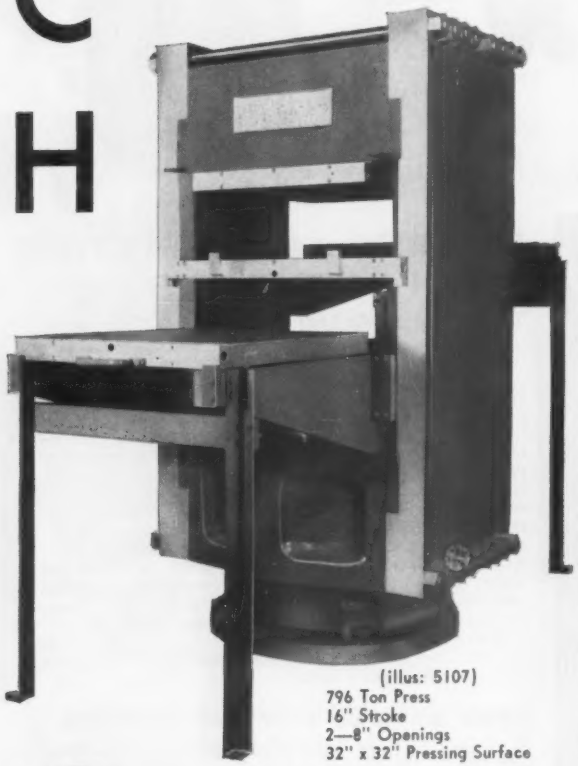

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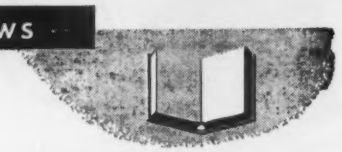
Reviews



Organic Reactions: Vol. X. Edited by Roger Adams et al. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 6 x 9 in. 563 pp. $12.

This latest addition to a series that began in 1942 continues the purpose of the previous volumes: presenting a compilation of *all* the important synthetic organic chemical reactions. That monumental effort has fortunately been placed in the hands of an extremely experienced group of editorial specialists and consultants headed by one of the leading organic chemists in the United States, a past-president of the American Chemical Society and of the American Association for the Advancement of Science. The staff appears to have had wide latitude, considering only the number of international authorities from whom it has obtained chapters for this series, and the amount of detailed factual data for which space is always found.

This book, for example, devotes nearly two thirds of its bulk to a paper by three Israeli chemists who review the Michael reaction concerning hydrocarbon acceptor systems. The chapter runs less than 400 pages, but has over 1,500 literature references—obviously not the stuff for the tyro in organic chemistry. Two other sections on the Japp-Klingemann reaction and on the coupling of diazonium salts with aliphatic carbon atoms are likewise far removed from the rudimentary level. However, there is little doubt that advanced chemists can find no other treatment of these specialized topics to rival the present volume in clarity and comprehensiveness. While a short abstract or summary would facilitate the utility of the individual chapters, the magnitude and flexibility of this publishing enterprise evokes undiluted admiration.

•

Plastics Engineering Handbook of The Society of the Plastics Industry, Inc. Third Edition. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 7 x 10 in. 565 pp. $15.

The rapid growth of new markets, new materials and new manufacturing techniques requires an ever more sophisticated approach to engineering data on plastic materials. It comes as no surprise, therefore, to learn that the Society for the Plastics Industry began to make plans for a third edition of its basic reference work soon after the second rolled off the presses in 1954. The newly revised and expanded volume, which has just become available, again demonstrates how a professional group through systematic committee work can accomplish one of its prime functions—transmitting the most recent information gathered by specialists to all members as well as to the technical audience at large.

The second edition, aiming at greater comprehensiveness, nearly doubled the size of the original handbook published in 1947. In line with the industry's maturity, the present version seeks to update and standardize descriptions of materials and techniques outlined in the 1954 volume rather than to add new subject matter. More than 200 technicians and researchers participated in this publications project of the Society to cover every step in the manufacturing process by a definitive text lucidly illustrated with photographs and schematic drawings. No longer have the writers found it necessary to reproduce the commercial standards developed in conjunction with the Department of Commerce. Such guides have grown too numerous and bulky in the intervening

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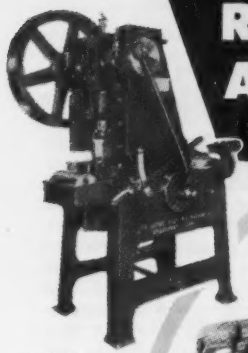

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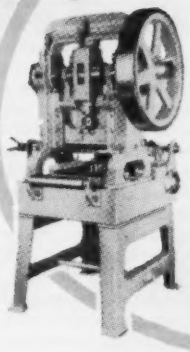

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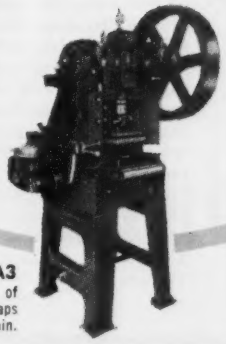

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six years; besides, they are subject to frequent revisions and are more easily obtainable than they were previously.

Other indications of the new industry orientation are furnished not only by the introductory section on nomenclature, which generally conforms to A.S.T.M. definitions, but also by the organization of the present handbook itself. Treatment of some engineering methods, such as compression and injection molding, has been abbreviated, while the chapters dealing with areas of greater innovation in materials like reinforced plastics, and processes like embedding and potting, have been expanded. Particular mention should be made of a new section on cellular plastics that presents the properties and applications of foam materials including epoxy, phenolic, polyethylene, polystyrene, silicone, urea-formaldehyde, urethane and rigid foams.

The chapters devoted to mold design have been rewritten along the same lines with the addition of new data on extrusion dies. The usefulness of the section on finishing has also been increased, greater attention being paid to laminating and coating of films. The concluding part that deals with testing emphasizes the authors' shift to functional considerations. Tests are not merely catalogued as in the previous edition, but grouped under specific performance characteristics with mention of radiation resistance a sign of the changed times.

All in all, the new handbook encompasses enough new ground, while maintaining the Society's criteria for accuracy and thoroughness, to make ownership of this volume a must for the engineer or technician working with plastics.

BOOKLETS, CATALOGS, etc.

Infrared Heat. Fostoria Corp., Dept. 49, Fostoria, Ohio. 8½ x 11 in. 20 pp.

While the emphasis of this booklet is on the economies accruing to the users of infrared over convection heating equipment, enough case material is presented to constitute a general introduction to production technology incident to such systems. Photographs illustrate various industrial situations of relevance, including force drying paint, baking enamel finishes on automotive trim and preheating plastic sheets before forming. A final section presents catalog information on portable, fixed type and horizontal ovens.

•

Drum Mixing Equipment. (Bulletin DM-290.) Process Equipment Div., U. S. Stoneware Co., Akron, Ohio. 8½ x 11 in. 12 pp.

Catalog information is the major concern of this bulletin on an expanded line of heavy duty, fiber drum tumblers. Some of the new features highlighted are quick-release drum holders, floor-level loading and built-in drum extenders. In connection with these new units, drum tumbler loading data is given in a series of charts from which recommended sizes can be calculated given the bulk and weight of materials to be mixed or blended.

•

Onyx Surface Active Agents. Onyx Oil & Chemical Co., Jersey City, N. J. 8½ x 11 in. 24 pp.

In this catalog, surface active agents are described by trade name, active ingredient, percent activity, physical state, general use, specific applications and properties. Products are divided into three general classes including anionic, cationic and non-ionic and a two page section explains the chemistry of each of these groups.

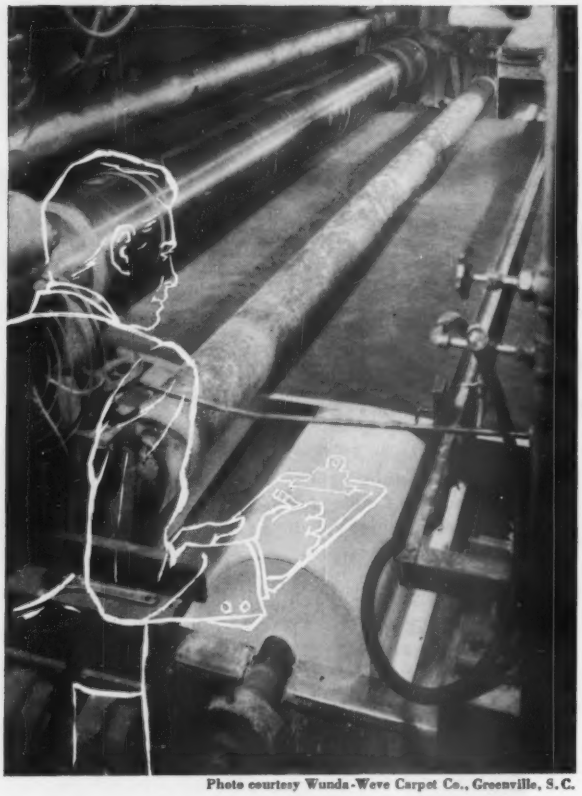

Photo courtesy Wunda-Weve Carpet Co., Greenville, S.C.

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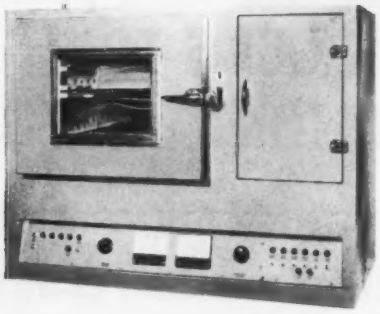

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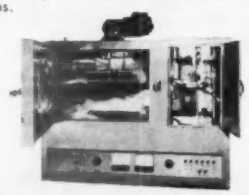

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***Cis-4* Polybutadiene.** Phillips Chemical Co., Bartlesville, Okla. 8½ x 11 in.

Just starting to become available in commercial quantities, *cis-4* is characterized in these pages as a controlled-structure polybutadiene with remarkable abrasion and heat resistance. Laboratory and road tests results, most of them based on natural rubber admixtures, are presented to bear this out. Of particular interest are compounding recipes that try to achieve the best possible balance between processing and vulcanizate properties of diverse stocks. The presentation is semi-technical and handsomely illustrated with color graphs.

•

Viton-O-Rings. (Catalog No. 5711.) Parker Seal Co., 10567 Jefferson Blvd., Culver City, Calif. 8½ x 11 in. 24 pp.

This handbook contains several tables of test data on some 150 fluids and gases for which O-rings can function as high temperature seals. In addition, recommendations are made on ring and groove design and general information given on three ring compounds and dimensions. References to applicable specifications and a list of functional limitations indicate the practical nature of the text.

•

Porous Barium Oxide. Barium and Chemicals, Inc., Willoughby, Ohio. 8½ x 11 in. 4 pp.

Briefly, in letter form, this publication enumerates the particularly useful properties of porous barium oxide when used as drying agent, dehydrator and desiccant. Excerpts from a Bureau of Standards research report are cited as evidence of the chemical's exceptional drying efficiency. These possible uses for the material—available in lump or granulated form—are mentioned: drying hydrocarbons, aldehydes, alcohols and gases, all with a minimal dew point.

•

Darex Vinyl Acetate Homopolymer and Copolymer Emulsions. Dewey and Almy Chemical Division, W. R. Grace & Co., Cambridge, Mass. 8¾ x 11¼ in. 4 pp.

Darex vinyl acetate homopolymer and copolymer emulsions are discussed along with their properties and suggested applications. Pertinent information is offered in table form, facilitating the task of finding the proper product. The booklet includes Special Features; Total Solids; W./Ga.; Viscosity (cps.); Average Particle; Film Clarity; Water-Resistance; and Typical End-Uses.

•

Ridacto Accelerator Activator. Spencer Products Co., Inc., P. O. Box 339, Ridgewood, N. J. 9 x 11½ in. 7 pp.

This is a seven page brochure which describes Ridacto, an accelerator-activator. After listing some of the advantages and uses of this material, the brochure provides a series of typical formulas. Those included are Carcass Stocks Mixed Polymer; SBR Tread; Control of Natural Rubber Reversion; and Ridacto as Activator for Tetramethyl Thiuram Disulfide.

•

Handbook on Solid Woven Cotton Belting. Woven Fabric Belting Manufacturers Association, 11 West 42nd St., New York 36, N. Y. 8½ x 11 in. 20 pp.

Available to engineers, purchasing agents, original equipment manufacturers and industrial consumers, this manual gives the standards, characteristics and applications for untreated belting, synthetic rubber impregnated belting and wax or bituminous impregnated belting. Also included are helpful suggestions for better belt care.

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PRICES

Natural Rubber

Since our last report (April 1), the price of natural rubber on the New York Commodity Exchange has moved in a range of 87 points, high for the period being 40.75c reached on April 28, and low being 39.88c reached on April 21. The average price of spot rubber for the month of April was 40.35c based on 20 trading days. This compares with an average of 40.74c in the previous month.

With Senate action on the legislation for graduated stockpile sales still pending, announcement of government policy has already played a major part in the market picture. After House passage of the bill, the General Services Administration announced that 63,554 long tons were currently available, while 10,073 had been sold in March. The GSA report brought market fluctuations to an end with a strong price rally that set new contract highs, according to Merrill Lynch, Pierce, Fenner & Smith.

The GSA disposal program is due to total 470,000 long tons over a nine-year period. Some of its features are still grist for the market's rumor mill. One unconfirmed report, for example, predicted sales of "deteriorating" stocks at a discount. Trading aside, taxpayers should rejoice at possible savings of more than $60 million as GSA reduces the stockpile: over $7 million by cutting warehouse costs, about $30 million by eliminating the old rotation system costs, and $25 or $30 million as profit from surplus stock sales.

Malaya Widens Margin

Meanwhile, back at the plantation, Singapore trading maintained an ever widening premium over New York. The May quotation of 39.20c (U. S. equivalent) was 185 points above N. Y. July contracts, allowing 210 points and about 45 days for shipping. Apparently adverse reports from the U. S. were being discounted. Red China's purchasing at a rate of 400 to 500 tons a day also helped sustain the price structure.

Another anticipated customer, the Soviet Union, however again gave its order to London. Immediate delivery was arranged for 4,000 tons from the 72,000-ton British stockpile. This came on the heels of a £1 million purchase for 3,000 tons by the Russians, announced on March 23.

Favorable Trade Balance

In the U. S., natural rubber imports were almost equal to exports of synthetic. Taking re-export of natural rubber into account, this means that the U. S. has become a net exporter of rubber.

Total consumption figures for the first quarter of 1960 (423,733 tons) were almost unchanged from 1959 (421,367 tons) as the declining use of natural was offset by increasing use of synthetic. The March stock increase of 8,680 tons could be explained by GSA sales.

NEW YORK, MAY 2, 1960

Price Data

Closing Rubber Prices on New York Commodity Exchange

FROM APRIL 1 TO APRIL 30

Apr.	Spot	May	July	Sept.	Sales
1	40.50	40.00	39.40	38.90	80
2	....	....	....	....	..
3	....	....	....	....	..
4	40.25	39.65	39.20	38.65	74
5	40.13	39.75	39.25	38.80	32
6	40.38	40.15	39.65	39.20	93
7	40.38	40.08	39.60	39.05	61
8	40.50	40.30	39.70	39.25	67
9	....	....	....	....	..
10	....	....	....	....	..
11	40.50	40.00	39.45	39.00	29
12	40.13	39.90	39.30	38.90	79
13	40.25	39.95	39.15	38.70	19
14	40.38	40.05	39.35	38.80	40
15	....	....	....	....	..
16	....	....	....	....	..
17	....	....	....	....	..
18	40.38	40.15	39.50	39.00	10
19	40.25	39.76	39.15	38.70	62
20	40.13	39.85	39.20	38.65	38
21	39.88	39.72	39.20	38.70	72
22	40.13	40.10	39.40	38.92	30
23	....	....	....	....	..
24	....	....	....	....	..
25	40.50	40.44	39.82	39.35	70
26	40.50	40.40	39.70	39.30	25
27	40.38	40.25	39.65	39.10	16
28	40.75	40.60	39.95	39.35	59
29	40.63	40.55	39.72	39.21	70
30	....	....	....	....	..

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.40⅝
June	.40¼
July	.39⅞
Thin Latex Crepe:	
Spot	.45¾
Thin Brown Crepe, No. 2	.40
Flat Bark Crepe	.35½

London Market

(Standard Smoked Sheets)

June	41.70 — 41.85
July-Sept.	40.53 — 40.68

Singapore Market

(Standard Smoked Sheets)

June	39.88 — 39.96

Middling Upland Quotations

	Mar. 31	April 29		
	Close	High	Low	Close
May	32.91	33.25	33.24	33.25
July	32.60	32.85	32.80	32.83
Oct.	30.72	30.88	30.80	30.87

Notes & Quotes

"There is no justification for predicting a fabulous boom in the Sixties," cautioned E. B. Hathaway, Firestone vice-president, speaking to Rotarians in Akron, Ohio. Within limits imposed by armament expenditures, prosperity for the rubber industry seems assured however. Mr. Hathaway predicted a 60 per cent increase in gross national product by 1970, based on greater output, slowly rising prices and a U. S. population of 220 million in ten years.

Synthetic Rubber

Synthetic rubber production continued to climb during March, setting a new high of 138,745 long tons. The previous monthly peak of 130,742 tons had been recorded in January, as reported by the Rubber Manufacturers Association.

Synthetic also increased its share of total new rubber consumption: 67.11 per cent during the first quarter compared with 64.58 per cent for the same period last year. Looking behind this more favorable ratio for synthetic in general, we find the most significant rise in the styrene rubber sector. First quarter consumption figures showed styrene types amounting to some 235,000 tons currently as against about 225,000 in the equivalent period of 1959.

With the bulk of styrene rubber production earmarked for tire manufacture, a consideration of automotive sales becomes relevant. Here we note the usual seasonal upturn begun in the last ten days of March being maintained in early April. This caused some car makers to worry less about their one million inventory: 200,000 more than that of earlier years. The glut was in part attributed to customer indecision which of the more than 140 models to choose.

Small Cars in Big Demand

Compact cars accounted for most of the recent boost in sales. About 20 to 25 per cent more of them were being sold in April than in March. This increase in popularity raised their proportion of sales even higher than their current 21 per cent production ratio.

At least two firms will be backing up the rising consumption of so-called "synthetic natural" rubber with new major supply sources this year. Phillips is completing a *cis-4* polybutadiene plant, while Shell expects to produce 20,000 tons of *cis*-polyisoprene annually at its new facility.

Comments on Competition

A Firestone official told a Florida audience that the days of natural rubber may be numbered. B. J. Ferkes, plant manager of the Industrial Products Division, pointed out that in the event of a World War III, the U. S. would no longer be dependent upon imports. Some of the newest synthetics, he said, excelled natural rubber in specific respects. Furthermore, lessening reliance on imports would rule out speculation and price fluctuations during any crisis.

Across the Atlantic, the British also welcomed the development of special synthetics without worrying about immediate losses to the competition. Dr. A. Bateman, head of the Natural Rubber Research Bureau, said that natural rubber alone could not meet rising world demand. He was commenting on the announced Durham Raw Materials import deal for two new synthetics from Goodrich-Gulf of Cleveland, Ohio.

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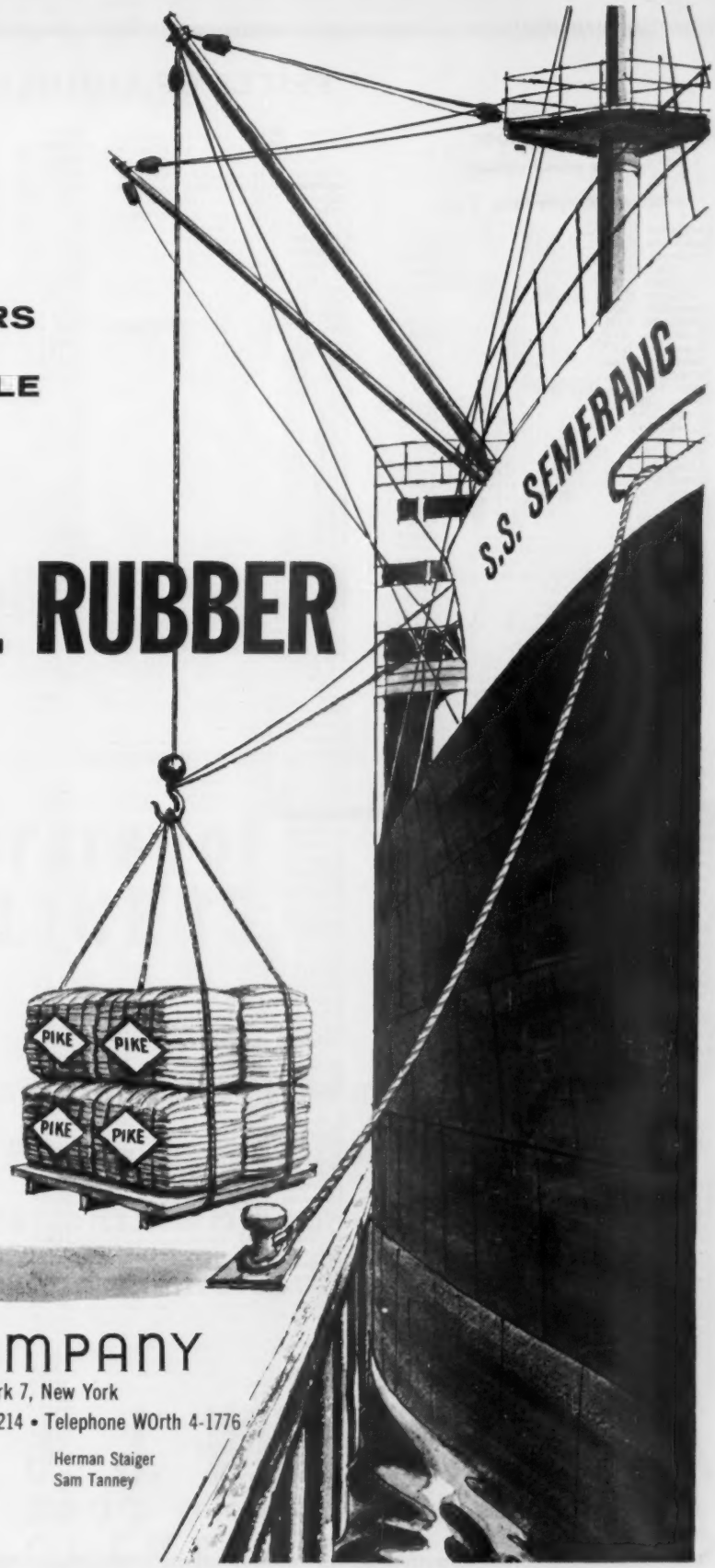

SJP

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SALES DIVISION: Sidney J. Pike, George Steinbach, George Jatinen, Herman Staiger, Sam Tanney

PRICES OF COMMERCIALLY AVAILABLE

Dry Rubber

(per pound carload)

Butadiene-Acrylonitrile Types

Butaprene NF	.4900
Butaprene NH	.6500
Butaprene NL	.5000
Butaprene NXM	.5800
Chemigum N1NS	.6400
Chemigum N3NS and N5	.5800
Chemigum N6	.5000
Chemigum N6B	.5000
Chemigum N7	.5000
Chemigum N8	.5000
Chemigum N600	.5000
Herecol N-33	.6800
Hycar 1001 and 1041	.5800
Hycar 1002	.5000
Hycar 1014	.6000
Hycar 1042 and 1043	.5000
Hycar 1051	.5800
Hycar 1052	.5000
Hycar 1053	.5000
Hycar 1072	.6400
Hycar 1203	.4600
Hycar 1312	.5000
Hycar 1411	.6200
Hycar 1432	.5900
Hycar 1441	.6200
Paracril AJ	.4850
Paracril B and BJ	.5000
Paracril BLT and BJLT	.5000
Paracril C and CLT	.5800
Paracril CV	.6300
Paracril D	.6500
Paracril 18-80	.6000
Paracril OZO	.4600
Polysar Krynac 800	.5000
Polysar Krynac 801	.5800
Polysar Krynac 802	.5000
Polysar Krynac 803	.5000

Butadiene-Styrene Types

Ameripol 1000	.2410
Ameripol 1001	.2410
Ameripol 1002	.2435
Ameripol 1006	.2410
Ameripol 1006 (crumb)	.2475
Ameripol 1007	.2410
Ameripol 1009	.2475
Ameripol 1009 (crumb)	.2590
Ameripol 1011	.2475
Ameripol 1012	.2425
Ameripol 1012 (crumb)	.2490
Ameripol 1013	.2410
Ameripol 1013 (crumb)	.2615
Ameripol 1500 and 1501	.2410
Ameripol 1502	.2410
Ameripol 1605	.1900
Ameripol 1703	.2060
Ameripol 1705	.2035
Ameripol 1707	.1910
Ameripol 1708	.1910
Ameripol 1710	.1885
Ameripol 1712	.1885
Ameripol 1805	.1550
Ameripol 4600	.2410
Ameripol 4650	.1820
Ameripol 4651	.1770
Ameripol 4652	.1425
Ameripol 4654	.1870
Ameripol 4655	.1820
Ameripol 4659	.1820
Ameripol 4660	.1870
Ameripol 4700	.1750
Ameripol 4750	.1545
Ameripol 4751	.1400
Ameripol 4752	.1600
Ameripol 4753	.1480
Ameripol 4760	.1576
Ameripol 4759	.1600
Ameripol 4761	.1710
ASRC 1000	.2410
ASRC 1001 and 1004	.2410
ASRC 1006	.2410
ASRC 1009	.2475
ASRC 1018	.2700
ASRC 1019	.2650
ASRC 1500	.2410
ASRC 1502	.2410
ASRC 1503	.2625
ASRC 1703	.2060
ASRC 1708	.1910
ASRC 1712	.1885
ASRC 1713	.1750
TSRC 3105 and 3106	.2410
ASRC 3110	.2600
Baytown 1600	.1930
Baytown 1601	.1930
Baytown 1602	.1930
Baytown 1801	.1760
Baytown 1803	.1740
C-102 (Shell)	.2300
Carbomix 3750	.1820
Carbomix 3751	.1545
Carbomix 3752	.1845
Carbomix 3753	.1640
Carbomix 3756	.1569
Carbomix 3757	.1480
Carbomix 3758	.1545
Carbomix 3760	.1496
CB-102 (Shell)	.1850
Copo 1500	.2410
Copo 1502	.2410
Copo 1505-NS	.2610
Copo 1712	.1885
Copo 1773	.2060
Copo 1778	.1910
Copo 3700	.1725
Copo 3701	.1750
Copo 3900	.2310
FR-S 146	.2410
FR-S 158	.3000
FR-S 173	.2060
FR-S 178	.1910
FR-S 181	.2410
FR-S 182	.2410
FR-S 184	.1885
FR-S 1000	.2410
FR-S 1001	.1410
FR-S 1004	.2410
FR-S 1006	.2410
FR-S 1007	.2410
FR-S 1009	.2475
FR-S 1010	.2600
FR-S 1012	.2425
FR-S 1013	.2410
FR-S 1014	.2810
FR-S 1500	.2410
FR-S 1502	.2410
FR-S 1703	.2060
FR-S 1710	.1885
FR-S 1712	.1885
Gentro 1500	.2410
Gentro 1712	.1885
Gentro-Jet 9152	.2080
Gentro-Jet 9153	.1820
Gentro-Jet 9154	.1845
Gentro-Jet 9250	.1580
Gentro-Jet 9251	.1640
Gentro-Jet 9252	.1670
Gentro-Jet 9275	.1500
Naugapol 1016	.2650
Naugapol 1018	.2700
Naugapol 1019	.2650
Naugapol 1022	.2950
Naugapol 1023	.3150
Naugapol 1503	.2625
Naugapol 1504	.0330
Naugapol 6003	.2700
Naugapol 6100	.3100
OB-102 (Shell)	.1825
OB-104 (Shell)	.1475
OB-106 (Shell)	.1510
OB-110 (Shell)	.1410
OB-111 (Shell)	.1540
OB-113C (Shell)	.1750
OB-114C (Shell)	.1420
OB-116 (Shell)	.1810
Philprene 1000	.2410
Philprene 1001	.2410
Philprene 1006	.2410
Philprene 1009	.2475
Philprene 1018	.2700
Philprene 1019	.2650
Philprene 1500	.2410
Philprene 1502	.2410
Philprene 1503	.2625
Philprene 1601	.1930
Philprene 1603	.1960
Philprene 1605	.1900
Philprene 1703	.2060
Philprene 1708	.1910
Philprene 1712	.1885
Philprene 1803	.1740
Philprene 1805	.1550
Plioflex 1006	.2410
Plioflex 1500C	.2410
Plioflex 1502	.2410
Plioflex 1507	.2410
Plioflex 1508	.2410
Plioflex 1510	.2410
Plioflex 1710C	.1885
Plioflex 1712C	.1885
Plioflex 1713	.1750
Plioflex 1714C	.1725
Plioflex 1773	.2060
Plioflex 1778	.1910
Polysar Kryflex 200	.2510
Polysar Krylene	.2410
Polysar Krylene NS	.2410
Polysar Krynol 651	.1885
Polysar Krynol 652	.1910
Polysar S	.2410
Polysar S-50	.2410
Polysar S-X 371	.2550
Polysar SS-250	.2875
S-1000	.2300
S-1002	.2325
S-1006	.2300
S-1009	.2400
S-1011	.2325
S-1013	.2300
S-1500	.2300
S-1502	.2300
S-1509	.2300
S-1600	.1825
S-1602	.1825
S-1604	.1825
S-1605	.1800
S-1606	.1750
S-1607	.1750
S-1703	.1950
S-1707	.1800
S-1709	.1775
S-1710	.1775
S-1712	.1775
S-1778	.1800
S-1800	.1475
S-1802	.1410
S-1803	.1650
S-1804	.1750
S-1806	.1510
S-1807	.1540
S-1808	.1420
S-7652	.1875
S-7701	.1850
SP-103 (Shell)	.2900
Synpol 1000	.2410
Synpol 1001	.2410
Synpol 1002	.2435
Synpol 1006	.2410
Synpol 1007	.2410
Synpol 1009	.2475
Synpol 1012	.2425
Synpol 1013	.2410
Synpol 1061	.2410
Synpol 1500	.2410
Synpol 1502	.2410
Synpol 1551	.2410
Synpol 1703	.2060
Synpol 1707	.1910
Synpol 1708	.1910
Synpol 1712	.1885
Synpol 8103	.2401
Synpol 8151	.1820
Synpol 8152	.1860
Synpol 8200	.1910
Synpol 8201	.1750
Synpol 8202	.1725
Synpol 8208	.1750
Synpol 8255	.1480
Synpol 8253	.1584
Synpol 8254	.1545
Synpol 8266	.1598
Synpol 8267	.1640

Butyl Rubbers

Enjay Butyl 035 and 150	.2300
Enjay Butyl 165 NS	.2400
Enjay Butyl 215	.2300
Enjay Butyl 217	.2300
Enjay Butyl 218	.2300
Enjay Butyl 268 NS	.2400
Enjay Butyl 325	.2300
Enjay Butyl 365 NS	.2400
Polysar Butyl 100	.2450
Polysar Butyl 101	.2775
Polysar Butyl 200 and 300	.2450
Polysar Butyl 301	.2550
Polysar Butyl 400	.2450

Chlorosulfonated Polyethylene

Hypalon 20	.4700
Hypalon 30	.6000
Hypalon 40	.5000

Fluoroelastomers

Kel-F Fluorel	$15.00
Kel-F 3700 and 5500	$16.00
Vitron A and A-HV	$10.00
Viton B	$13.00

Neoprene

	(prices l.c.l.)
Neoprene Types AC and CG	.5500
Neoprene Type AD	.5500
Neoprene Type FB	.6500
Neoprene Type GN	.4100
Neoprene Type GN-A	.4100
Neoprene Type GRT	.4200
Neoprene Type KNR	.7500
Neoprene Type S	.4200
Neoprene Type W	.3900
Neoprene Type WB	.4100
Neoprene Type WHV	.3900
Neoprene Type WRT	.4500
Neoprene Type WX	.4100

SYNTHETIC RUBBER POLYMERS

Polysulfide Rubbers

	(prices f.o.b.)
Thiokol Type A	.5000 [2]
Thiokol Type FA	.6900 [2]
Thiokol Type ST	1.2500 [2]

Silicone Rubbers*

	(prices f.o.b.)
GE (compounded)	2.50 [2]
GE Silicone Gum (not compounded)	4.00 [2]
Silastic (compounded)	2.50 [2]
Silastic (gums)	4.00 [2]
Union Carbide (gums)	4.00 [2]
Union Carbide (compounds)	2.50 [2]

Latex

(per pound carload)

Butadiene-Acrylonitrile Types

Butaprene N-300	.4600 [1]
Butaprene N-400 and N-401	.5400 [1]
Chemigum 200	.4800 [2]
Chemigum 235	.5300 [2]
Chemigum 236	.5300 [2]
Chemigum 245	.4500 [2]
Chemigum 246	.4500 [2]
Chemigum 247	.4500 [2]
Chemigum 248	.4500 [2]
Hycar 1512	.4500 [2]
Hycar 1551	.5300 [2]
Hycar 1552	.4500 [2]
Hycar 1561	.5300 [2]
Hycar 1562	.4500 [2]
Hycar 1571	.5300 [2]
Hycar 1572	.4500 [2]
Hycar 1577	.4500 [2]
Nitrex 2612	.4500 [1]
Nitrex 2616	.5300 [1]
Nitrex 2620	.4500 [1]
Nitrex 2625	.4500 [1]
Tylac 640	.4500 [1]
Tylac 740	.4900 [1]
Tylac 840	.5300 [1]
Tylac 1640	.5400 [1]
Tylac 2241	.5300 [1]
Tylac 2430	.5000 [1]
Tylac 2570	.5300 [1]
Tylac 2830	.4500 [1]

Butadiene-Styrene Types

CL-101 (Shell)	.2800 [2]
Copo 2000	.2775 [2]
Copo 2101	.3000 [2]
Copo 2102	.3200 [2]
Copo 2105	.3200 [2]
Copo 2108	.3000 [2]
Copo 2109	.2775 [2]
Copo 2110	.3200 [2]
Copo 3852	.2900 [2]
FR-S 110	.3000 [2]
FR-S 150	.3000 [2]
FR-S 151	.2900 [2]
FR-S 174	.2950 [2]
FR-S 176	.2775 [2]
FR-S 2000	.2775 [2]
FR-S 2001	.2775 [2]
FR S 2002	.3000 [2]
FR S 2003	.3050 [2]
FR-S 2004	.3050 [2]
FR-S 2006	.2900 [2]
FR-S 2105	.3200 [2]
Naugatex 2000	.2775 [1]
Naugatex 2001	.2775 [1]
Naugatex 2002	.3000 [1]
Naugatex 2006	.2900 [1]
Naugatex 2105	.3200 [1]
Naugatex 2107	.3200 [1]
Naugatex 2108	.3000 [1]
Naugatex 2113	.2900 [1]
Naugatex J-8174	.3200 [1]
Naugatex J-8535	.3000 [1]
Pliolite 2000	.2775 [2]
Pliolite 2001	.2775 [2]
Pliolite 2076	.2900 [2]
Pliolite 2104	.3200 [2]
Pliolite 2105	.3200 [2]
Pliolite 2107	.3200 [2]
Pliolite 2108	.3000 [2]
S-2000 and S-2006	.2600 [2]
S-2101	.2600 [2]
S-2105	.2800 [2]
S-2108	.2900 [2]

Neoprene

Neoprene Latex 60	.4000 [2]
Neoprene Latex 571	.3700 [2]
Neoprene Latex 572	.3900 [2]
Neoprene Latex 601-A	.4000 [2]
Neoprene Latex 673	.5000 [2]
Neoprene Latex 735	.3800 [2]
Neoprene Latex 736	.3800 [2]
Neoprene Latex 842-A	.3700 [2]
Neoprene Latex 950	.4700 [2]

Polysulfide Rubbers

Thiokol Type MX	.8000 [2]
Thiokol Type WD-2	1.2500 [2]
Thiokol Type WD-6	.8000 [2]

Notes: (1) Freight allowed. (2) Freight extra. (3) Freight prepaid. *Covers a wide range of compounds. Readers are urged to check specific prices with producers.

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Columbian Carbon, International, Inc.
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CANADIAN AGENT
Columbian Carbon (Canada) Ltd.,
7 Superior Ave., Toronto, Ontario, Canada

J. J. WHITE Products Co.
7000 UNION AVENUE
CLEVELAND 5 OHIO

MARKETS

(continued)

Reclaimed Rubber

In the first three months of this year, the Rubber Manufacturers Association reports 82,517 long tons of reclaimed rubber were produced, against the 80,390 long tons produced in the first three months of the previous year.

In the first quarter of this year, a total of 78,292 long tons of reclaimed rubber were consumed against the 77,342 long tons consumed in the first three months of the preceding year. As of March 31, there were 30,410 long tons of reclaimed on hand.

The reclaimed rubber market continues to behave as earlier indications suggested it would. Reclaim consumption in 1960 should be in the order of 320,000 long tons. Exports, so far, have been good, and this should be a contributing factor to the general good picture.

(Prices for All Areas Except Calif.)

	per lb.
Premium Grade Whole Tire	.11½
First Line Whole Tire	.11
Second Line Whole Tire	.10½
Third Line Whole Tire	.10¼
Fourth Line Whole Tire	.09¾
Black Carcass	.15¼
No. 1 Light Colored Carcass	.22
No. 1 Peel	.11
Butyl Tube Reclaim	.14
Natural Rubber Black Tube	.16
Natural Rubber Red Tube	.21
Natural Rubber Gray Tube	.21

Scrap Rubber

The Rubber Manufacturers Association indicates that a total of 75,999 long tons of scrap rubber were consumed in the United States in the first three months of this year. If the market were to continue at this pace, close to 320,000 long tons of scrap rubber will have been consumed at year end. This will be higher than many expected earlier this year.

Many factors will make their influence felt before too much more time passes, however. Automobile production will likely slow with the approach of the summer months. In addition, several reclaimers will close for the annual vacation period. In balance, scrap rubber should enjoy a relatively good year, nevertheless, with actual consumption at or near a 300,000 long ton level.

(Prices Delivered Akron)

Mixed tires	ton	15.00
Light colored carcass	lb.	.05½
No. 1 peelings	ton	50.00
No. 2 peelings	ton	28.00
No. 3 peelings	ton	23.00
Buffings	ton	16.00
Truck and Bus S.A.G.	ton	22.00
Passenger S.A.G.	ton	20.00
Natural Rubber Red Tubes	lb.	.07½
Natural Rubber Black Tubes	lb.	.07
Butyl Rubber Tubes	lb.	.08½

Tire Fabrics

The nylon-rayon battle entered another hard fought round with an annual tire cord market of $350 million at stake. Original equipment for 1961 model cars was the immediate issue to be decided shortly by auto manufacturers.

William Dalton, president of Tyrex, Inc., predicted that rayon cord would continue to be standard equipment for '61 models, as it has been for virtually all '59 and '60 cars. Auto and tire makers in Detroit and Akron indicated that this claim was justified.

In 1960, DuPont and other nylon cord producers had to be content with supplying for Goodyear's "Captive Air" tire having limited station wagon use, and for about 2000 tires on Chrysler's 300-F sports model. This, despite two price cuts since last summer, matched by Tyrex producers for a maximum reduction of 16.6 per cent.

American Enka Corp., a major rayon cord supplier, reported sharply lower earnings for the last two quarters, in no small part attributable to the price cuts. Enka's president, P. B. Stull, suggested diversification may be the company's way out of this bottleneck. Wire and cable goods accounted for 14 per cent of total sales last year and, in Mr. Stull's opinion, "prospects are promising for the development of new dielectric products."

Diversification within its tire yarn business is also part of Enka's solution. Since 1955, rayon yarn's share of total sales has dropped from 36 to 24 per cent, while nylon's was rising from 2 to 13 per cent. In the words of company officials, being left out in the cold if nylon should capture the market after all is not their intention. Expanding nylon production from 3 to 6½ million pounds by 1961 is proof enough of the new strategy.

Recent import figures emphasize rayon's spurt last year. A 13-fold increase of 1958's total was noted for rayon tire cord and fabric shipped to the U. S.: from about 400,000 to 5.2 million pounds—nearly two-thirds of it by Sweden. Exports, however, dropped 25 per cent, to 14.8 million pounds in 1959, according to the U. S. Census.

(Prices f.o.b. Shipping Point)

Rayon Tire Cord

1100	lb.	.62½
1650	lb.	.62
2200	lb.	.62½

Nylon Tire Cord

210	lb.	1.75
840	lb.	1.47

Rayon Graded Fabric

1100	lb.	.69
1650	lb.	.63½
2200	lb.	.63

Cotton Chafers

8.9 oz. (per square yard)	lb.	.71
9.25 oz. (per square yard)	lb.	.72
11.65 oz. (per square yard)	lb.	.66
14.4 oz. (per square yard)	lb.	.75

Liquid Latex

Natural: According to the Rubber Manufacturers Association, 14,754 long tons of natural rubber latex were imported into the United States in the first quarter of the current year, just about 7,000 long tons less than were imported in the first quarter of the preceding year.

As for consumption, in the first quarter of this year, a total of 15,467 long tons of natural rubber latex were used in the United States against the 20,725 long tons used in the first three months of the previous year. As of March 31, 1960, there were 14,460 long tons of natural latex on hand, equivalent to about a one month's supply.

It will be seen that, as expected, natural latex is suffering the effects of high price and the reduction in the output of latex foam. Natural latex is currently selling at a 47-48c level at East Coast ports in carload lots.

In accordance with our earlier estimates, it would appear as though some 60,000 long tons of natural latex will be imported into the United States during this year, while a total of slightly in excess of 60,000 long tons will be consumed.

Synthetic: Under current conditions, synthetic rubber latex cannot help but reap any benefits which may accrue as a result of lessened consumption of natural latex. It still appears as if a total of 95,000 long tons of all types of synthetic rubber latex will be consumed in the current year against last year's 105,000 long tons.

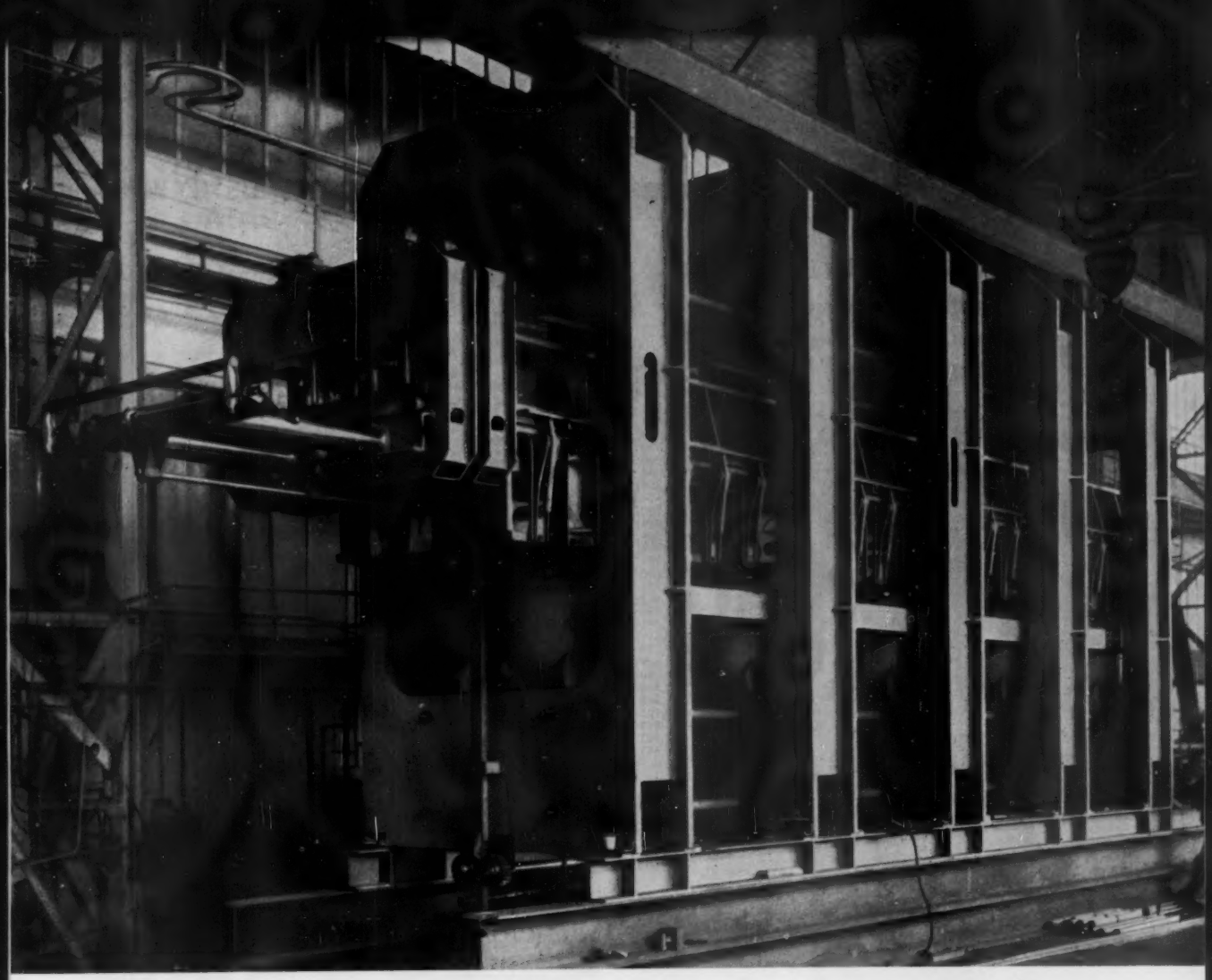
Cotton

The price of middling uplands on the New York Cotton Exchange moved in a range of 5 points since our last report (April 1), high for the period being 34.15c reached on April 29, while the low of 34.10c was reached on every other day during the month. The average for the month of April was 34.10c based on 20 trading days. This compares with an average of 33.54c in the previous month.

The market has been consistently steady during recent weeks. Buying was due to trade covering and influenced by the heavy export movement. There has been renewed buying of cotton gray goods and large cotton consumption.

The Department of Agriculture continues to control the merchandising of raw cotton. To April 15th, the Commodity Credit Corp. purchased 8,644,943 bales; sold 6,004,078 bales, leaving 2,158,694 bales unsold. The CCC made loans on 332,311 bales, and 225,913 bales were repossessed, leaving a net stock of 106,398 bales.

The weather in the cotton belt was mostly favorable, and it is expected that 17,500,000 acres will be planted to cotton. The cotton that has come up has had a good stand, trade reports state.



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STATISTICS of the industry

PERTINENT INDUSTRY DATA

Natural Rubber in the United States

(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1931	501,788	355,200	25,609	322,000
1932	414,668	336,700	20,937	379,000
1933	418,902	412,400	20,576	365,000
1934	463,018	462,500	23,856	355,000
1935	467,146	495,500	11,391	303,000
1936	488,145	575,000	12,582	223,000
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946	400,687	277,597	4,338	237,467
1947	688,354	562,661	4,101	129,038
1948	735,227	627,332	6,673	141,541
1949	660,792	574,522	6,253	106,619
1950	802,249	720,268	8,644	89,215
1951	733,048	454,015	2,603	76,569
1952	805,997	453,846	3,024	95,260
1953	647,150	553,473	8,376	112,316
1954	596,848	596,285	7,443	104,543
1955	635,174	634,800	10,611	110,105
1956	580,510	563,095	11,300	115,949
1957	499,121	539,761	10,146	100,901
1958	474,409	484,492	20,085	76,491
1959	526,048	555,044	18,750	79,405
1959:				
Aug.	46,453	46,914	1,650	80,106
Sept.	41,420	49,582	1,480	76,935
Oct.	48,378	49,049	1,202	74,172
Nov.	48,844	42,039	1,414	78,503
Dec.	47,444	42,950	1,139	79,405
1960:				
Jan.	43,140	46,771	1,100	76,877
Feb.	41,042	46,155	1,700	74,230

Source: U. S. Department of Commerce.

U. S. Imports of Natural Rubber

Year	Dry: Long Tons	Dry: Declared Value	Latex: Long Tons	Latex: Declared Value	Total Imports
1936	467,064	152,072,496	19,852	6,659,899	486,916
1937	574,600	237,307,041	23,185	10,213,670	597,785
1938	397,640	125,373,864	11,944	4,168,127	409,584
1939	469,946	167,586,780	27,437	10,467,552	497,383
1940	781,202	303,308,823	33,789	14,593,466	814,991
1941	989,498	401,976,317	34,797	15,965,627	1,024,345
1942	266,276	112,337,426	10,646	5,630,667	276,922
1943	50,358	31,369,198	1,890	1,312,202	52,248
1944	103,847	73,908,549	3,091	2,092,211	106,938
1945	134,408	95,814,102	4,773	3,115,853	139,181
1946	376,502	228,796,110	8,421	5,843,085	384,923
1947	691,087	306,951,814	17,542	9,787,722	708,629
1948	702,293	290,849,177	32,745	18,288,223	735,038
1949	630,808	225,343,624	29,743	14,968,650	660,551
1950	747,109	416,222,598	54,401	41,764,486	801,510
1951	677,874	727,343,348	54,963	80,178,309	732,837
1952	756,987	578,179,519	48,228	40,563,116	805,215
1953	571,635	284,909,223	75,511	46,353,333	647,146
1954	522,364	219,098,143	74,483	42,755,029	596,847
1955	542,507	360,435,303	92,825	80,163,114	635,332
1956	499,479	334,990,045	71,709	61,795,844	564,321
1957	475,958	291,337,628	78,567	58,249,788	554,174
1958	406,059	153,127,066	67,593	45,047,040	473,652
1959	498,749	304,594,223	79,205	60,939,662	577,954
1959:					
July	42,058	27,606,695	5,469	4,524,071	47,527
Aug.	38,228	26,533,930	7,131	5,487,070	45,359
Sept.	40,696	29,259,772	6,947	5,698,625	47,643
Oct.	41,631	31,108,534	6,747	5,612,350	48,378
Nov.	43,789	33,218,969	5,055	3,986,638	48,844
Dec.	40,739	29,686,284	6,704	6,003,513	47,443

Source: Bureau of the Census, U. S. Department of Commerce.

World Production of Natural Rubber

(Including Latex)

(Long Tons)

Year	Malaya	Indonesia	Ceylon	Viet Nam & Cambodia	Latin America*	Rest of World*	Total*
1947	646,362	277,951	89,000	38,128	34,928	172,782	1,260,000
1948	698,189	432,349	95,000	43,935	29,158	225,557	1,525,000
1949	671,503	432,996	89,500	43,010	27,318	225,659	1,490,000
1950	694,090	696,472	113,500	48,482	26,902	280,299	1,860,000
1951	605,346	814,406	105,000	52,136	29,777	278,262	1,885,000
1952	584,238	750,494	96,500	63,134	35,475	261,211	1,790,000
1953	574,390	692,164	98,610	74,545	35,318	250,182	1,725,000
1954	584,435	738,670	93,935	78,024	26,833	280,112	1,802,500
1955	639,128	733,786	93,830	80,172	6,000	344,584	1,897,500
1956	568,550	686,667	95,389	89,072	22,457	336,015	1,857,000
1957	638,706	684,515	98,164	58,440	28,351	381,824	1,890,000
1958	663,644	614,561	100,196	103,613	26,268	446,718	1,955,000
1959	698,249	721,359	91,696	108,398	23,962	421,336	2,065,000
1959:							
July	62,544	54,291	7,175	10,300	2,552	43,138	180,000
Aug.	61,426	61,402	8,926	9,736	1,607	34,403	177,500
Sept.	61,809	55,840	8,197	9,590	1,241	33,323	170,000
Oct.	61,455	71,004	9,630	10,919	600	38,892	192,500
Nov.	59,732	62,548	9,893	13,594	600	38,633	185,000
Dec.	65,312	74,163	12,042	14,014	600	33,869	200,000

Source: International Rubber Study Group. * Estimated.

World Consumption of Natural and Synthetic Rubber

(Including Latex)

(Long Tons)

Year	United States	United Kingdom	Canada	Europe*	Rest of World*	Total*
1946	1,039,296	126,770	39,196	145,000	115,804	1,467,500
1947	1,122,327	156,399	61,452	242,500	153,548	1,735,000
1948	1,069,404	196,286	62,121	392,000	182,379	1,902,500
1949	988,903	186,622	56,362	446,500	207,388	1,887,500
1950	1,258,537	222,425	68,695	448,500	287,055	2,285,000
1951	1,214,298	238,101	70,809	476,500	314,941	2,312,500
1952	1,261,413	202,179	67,099	550,000	254,901	2,335,000
1953	1,338,309	211,453	73,394	521,000	343,606	2,500,000
1954	1,233,012	247,612	71,656	544,250	408,094	2,505,000
1955	1,529,699	266,804	84,528	630,000	464,250	2,980,000
1956	1,436,482	232,345	91,458	775,500	489,215	3,025,000
1957	1,464,540	239,021	88,379	777,250	565,710	3,135,000
1958	1,364,404	238,439	83,904	905,000	638,353	3,230,000
1959	1,626,370	259,655	101,484	985,250	689,741	3,662,500
1959:						
Aug.	137,951	15,372	6,387	59,000	51,290	270,000
Sept.	146,111	26,426	9,227	86,250	66,968	335,000
Oct.	147,643	22,117	8,686	83,750	65,304	327,500
Nov.	125,922	22,730	9,067	94,250	63,031	315,000
Dec.	132,002	25,668	7,885	86,250	65,695	317,500

Source: International Rubber Study Group. * Estimated.

Rim Production

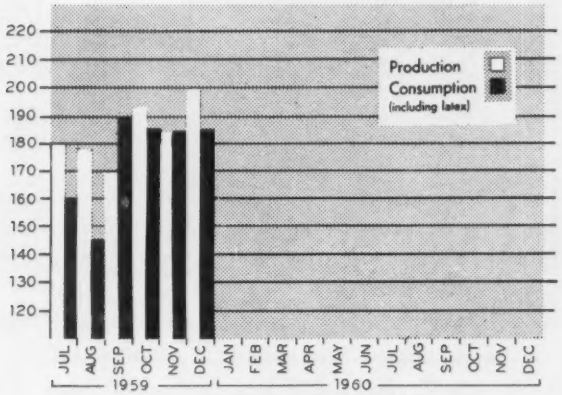
	1955	1956	1957	1958	1959
Passenger Car	38,092,080	27,109,610	27,301,567	20,665,688	25,412,177
Truck & Bus	6,642,329	6,315,428	5,468,223	3,887,910	5,019,261
Agricultural	1,931,768	1,416,938	1,368,127	1,218,240	1,386,866
Earth Mover	38,849	88,812	67,289	61,883	111,077
Total	46,705,036	34,930,788	34,205,206	25,833,721	31,929,381

	1959: Oct.	Nov.	Dec.	1960: Jan.	Feb.	March
Passenger Car	1,872,647	1,117,817	2,205,434	3,378,687	3,162,583	2,876,851
Truck and Bus	4225,625	183,752	421,976	541,886	602,427	551,323
Agricultural	74,174	79,419	77,892	78,648	153,386	115,565
Earth Mover	11,648	1,350	8,967	8,448	8,359	9,602
Total	2,184,094	1,382,338	2,714,269	4,007,669	3,926,754	3,553,341

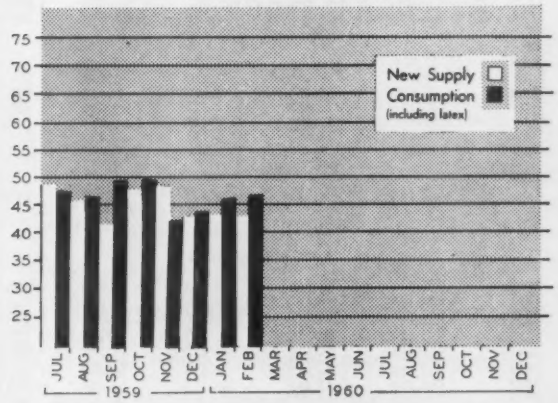
Source: The Tire & Rim Association, Inc.

STATISTICS at a glance

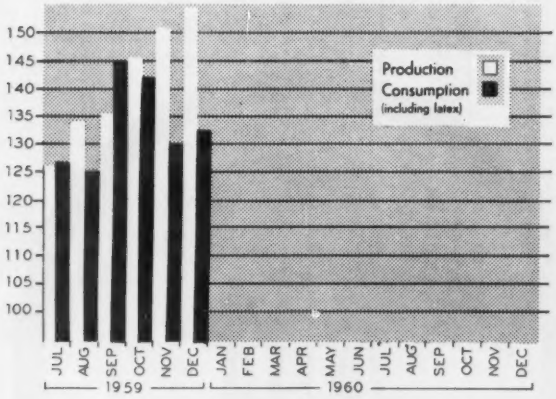
NATURAL RUBBER—WORLD
(thousands of long tons)



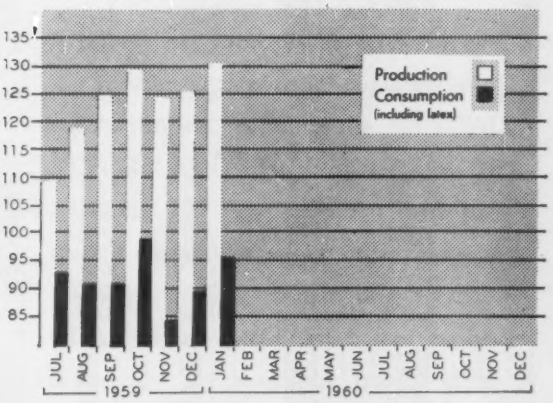
NATURAL RUBBER—UNITED STATES
(thousands of long tons)



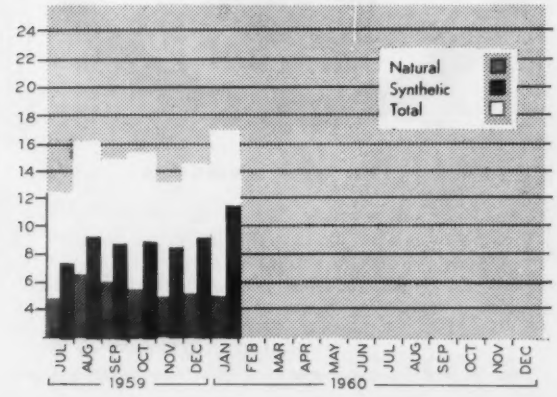
SYNTHETIC RUBBER—WORLD
(thousands of long tons)



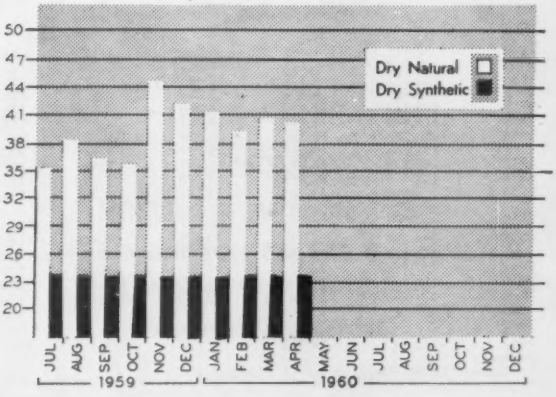
SYNTHETIC RUBBER—UNITED STATES
(thousands of long tons)



LATEX CONSUMPTION—UNITED STATES
(thousands of long tons)



PRICES—NATURAL AND SYNTHETIC
(cents per pound)



Synthetic Rubber in the United States

(All Quantities in Long Tons)

New Supply

Year	GR-S	Neoprene	Butyl	N-Type	Total
1949	310,529	35,215	54,046	11,072	410,932
1950	378,887	50,067	60,915	12,037	501,906
1951	704,529	58,907	76,475	15,333	855,244
1952	654,854	65,745	81,630	16,228	818,447
1953	680,728	80,495	79,801	20,198	861,222
1954	490,405	69,150	58,802	21,396	639,753
1955	801,145	91,357	56,179	32,623	982,304
1956	876,982	99,412	75,873	34,547	1,086,814
1957	913,321	110,721	67,418	33,618	1,125,078
1958	872,565	97,806	54,113	32,431	1,056,915
1959	1,134,379	124,815	82,704	43,588	1,385,486
1959:					
June	87,226	10,216	5,590	3,707	106,739
July	95,207	9,365	6,420	3,843	114,835
Aug.	97,494	10,471	8,179	3,451	119,545
Sept.	98,117	10,888	7,717	3,940	120,662
Oct.	107,120	10,099	8,223	3,864	129,306
Nov.	102,325	11,660	7,714	3,827	125,526
Dec.	102,157	11,475	8,661	3,486	125,779
1960:					
Jan.	106,853	11,958	8,171	3,760	130,742

Consumption

1960	416,230	43,781	66,348	11,930	538,289
1951	620,444	48,887	70,500	13,000	738,89.
1952	666,420	55,522	71,229	13,866	807,037
1953	624,181	65,900	77,826	16,929	784,836
1954	500,345	57,203	61,464	17,715	636,727
1955	741,997	72,876	53,991	26,035	894,899
1956	727,789	74,887	49,615	24,976	877,267
1957	767,218	75,461	55,413	25,187	923,279
1958	730,196	69,694	53,432	26,590	880,912
1959	886,275	84,955	65,454	34,638	1,071,322
1959:					
June	76,065	7,083	5,484	3,063	91,695
July	78,995	6,277	6,043	2,419	93,734
Aug.	75,340	7,117	5,533	3,047	91,037
Sept.	79,835	7,326	6,579	3,119	90,859
Oct.	81,963	7,538	5,965	3,128	98,594
Nov.	69,217	6,684	5,327	2,655	83,883
Dec.	73,871	6,996	5,489	2,696	89,052
1960:					
Jan.	78,902	7,279	6,006	2,861	95,048

Exports

1950	900	4,826	31	1,895	7,652
1951	483	6,825	216	1,725	9,249
1952	9,467	9,813	126	2,695	22,101
1953	7,692	11,494	237	3,245	22,668
1954	11,069	12,062	2,831	4,155	30,117
1955	60,704	18,098	9,895	4,593	93,290
1956	112,366	21,909	8,699	6,194	149,168
1957	157,977	30,242	8,748	6,377	203,344
1958	142,069	31,337	13,793	6,718	193,917
1959	211,300	39,551	21,700	8,256	280,843
1959:					
Apr.	19,154	3,741	2,135	527	25,557
May	12,281	2,942	2,587	642	18,452
June	21,871	2,522	2,386	937	27,716
July	19,814	4,105	1,580	440	25,939
Aug.	18,054	2,557	1,896	1,025	23,532
Sept.	22,506	4,864	2,240	692	30,302
Oct.	13,476	2,250	1,383	679	17,788
Nov.	18,916	3,362	1,242	648	24,168
Dec.	25,392	4,662	1,265	1,031	32,350

Stocks

1949	77,731	4,654	12,224	3,433	98,042
1950	36,942	5,733	7,243	2,840	52,758
1951	105,271	8,379	12,481	3,821	129,912
1952	83,861	8,535	22,716	3,875	118,987
1953	135,153	11,480	24,866	4,346	175,845
1954	115,499	11,349	19,267	4,280	150,395
1955	108,989	12,220	10,500	6,030	137,739
1956	151,763	14,077	28,744	7,934	202,518
1957	140,199	18,843	31,489	7,454	197,985
1958	143,533	15,688	18,770	7,292	185,283
1959	174,606	14,164	13,188	8,888	210,846
1959:					
Aug.	148,795	15,745	10,558	8,418	183,516
Sept.	147,400	12,845	9,535	8,526	178,306
Oct.	157,768	13,385	10,805	8,649	190,607
Nov.	168,490	13,043	11,447	9,077	202,057
Dec.	174,606	14,164	13,188	8,888	210,846
1960:					
Jan.	183,242	14,985	13,838	9,403	221,468

Source: U. S. Department of Commerce.

Natural and Synthetic Rubber Latex in the United States

(All Quantities in Long Tons)

New Supply

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Grand Total
1945	4,768	15,176	7,077	.....	22,253	27,021
1946	8,012	24,810	13,595	.....	38,405	46,417
1947	17,675	22,474	6,089	.....	28,563	46,238
1948	32,630	21,494	5,022	.....	26,516	59,146
1949	29,974	21,357	3,651	.....	25,008	54,982
1950	54,401	31,339	5,725	.....	37,064	91,465
1951	54,963	32,972	6,866	2,948	42,786	97,749
1952	48,228	42,273	7,598	4,164	54,035	102,263
1953	75,511	48,112	9,026	5,844	62,982	138,493
1954	74,483	48,379	8,214	6,866	63,459	137,942
1955	92,754	69,364	10,432	10,798	90,594	183,348
1956	72,013	69,720	10,642	10,650	91,012	163,025
1957	72,252	74,535	10,403	11,420	96,358	168,610
1958	67,591	65,669	10,679	11,560	87,908	155,499
1959	72,502	93,303	13,127	14,034	120,464	192,966
1959:						
June	7,445	6,730	1,223	1,196	9,149	16,594
July	5,469	6,871	956	1,279	9,106	14,575
Aug.	7,131	8,225	1,242	1,258	10,725	17,856
Sept.	6,947	8,201	956	1,364	10,521	17,468
Oct.	6,747	9,424	1,020	1,187	11,631	18,378
Nov.	5,055	8,144	1,206	1,104	10,454	15,509
Dec.	6,705	8,429	1,017	1,045	10,491	17,196
1960:						
Jan.	5,857	9,720	1,154	3,760	14,634	20,491

Consumption[1]

1945	3,886	14,500	6,800	....	21,300	25,186
1946	5,714	23,500	13,000	....	36,500	42,214
1947	13,909	22,500	6,500	....	29,000	42,909
1948	28,489	21,500	5,250	....	26,750	55,239
1949	36,117	21,500	3,750	....	25,250	61,367
1950	56,138	31,000	5,500	....	36,500	92,638
1951	46,750	31,031	6,279	2,628	39,938	86,688
1952	53,567	40,562	7,368	3,093	51,023	104,590
1953	67,375	46,473	7,981	3,654	58,108	125,483
1954	75,931	44,173	7,251	4,507	55,931	131,862
1955	86,478	63,982	8,736	8,495	81,213	167,691
1956	74,082	62,762	8,708	8,021	79,491	153,573
1957	75,009	68,305	9,039	8,630	85,974	160,983
1958	70,183	60,283	9,555	10,549	80,387	150,570
1959	71,745	80,646	11,394	13,258	105,298	177,043
1959:						
June	5,622	6,497	910	1,150	8,557	14,179
July	5,004	5,804	919	940	7,663	12,667
Aug.	6,613	7,348	961	1,116	9,425	16,038
Sept.	6,342	6,919	916	1,178	9,007	15,349
Oct.	6,153	7,388	969	1,158	9,515	15,668
Nov.	4,858	6,427	893	981	8,301	13,159
Dec.	5,206	7,428	895	993	9,316	14,522
1960:						
Jan.	5,487	7,889	956	2,861	11,706	17,193

Stocks at End of Period

1945	3,121	....	....	....	....	3,121
1946	4,865	....	....	....	....	4,865
1947	5,033	....	....	....	....	5,033
1948	11,235	....	....	....	....	11,235
1949	5,063	....	....	....	....	5,063
1950	4,927	....	....	....	....	4,927
1951	4,752	3,727	1,245	532	5,504	10,256
1952	6,201	5,040	1,019	902	6,961	13,162
1953	13,532	4,794	1,117	721	6,632	20,164
1954	11,133	5,134	1,087	811	7,032	18,165
1955	13,203	6,980	1,236	1,807	10,203	23,406
1956	12,064	7,451	1,384	1,558	10,393	22,457
1957	14,454	8,347	1,267	1,974	11,588	26,042
1958	8,900	7,672	1,663	2,519	11,854	20,754
1959	12,717	8,226	1,581	2,883	12,690	25,067
1959:						
June	11,063	7,314	1,601	2,432	11,347	22,410
July	10,752	6,983	1,528	2,761	11,272	22,024
Aug.	11,472	6,775	1,576	2,779	11,130	22,602
Sept.	11,742	7,196	1,498	2,810	11,504	23,246
Oct.	12,220	7,570	1,464	2,888	11,922	24,142
Nov.	11,707	8,279	1,451	2,975	12,705	24,412
Dec.	12,717	8,228	1,581	2,883	12,690	25,067
1960:						
Jan.	12,781	7,781	1,627	9,403	18,811	31,592

Source: U. S. Department of Commerce.
Note: (1) GR-S and Neoprene consumption estimated through 1950.

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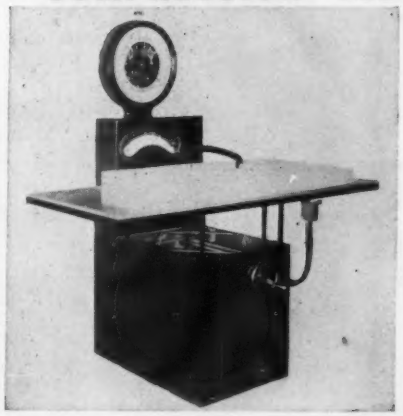

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Rubber Industry Employment Earnings and Hours

All Rubber Products

Mo.	1958 Production Workers (thousands)	1958 Average Weekly Earnings	1958 Average Weekly Hours	1958 Average Hourly Earnings	1959 Production Workers (thousands)	1959 Average Weekly Earnings	1959 Average Weekly Hours	1959 Average Hourly Earnings
Jan.	200.9	$87.48	38.2	$2.29	199.1	$100.28	41.1	$2.45
Feb.	191.3	85.04	37.3	2.28	198.8	101.09	41.6	2.44
Mar.	184.0	87.02	38.0	2.29	201.5	103.74	42.0	2.43
Apr.	176.0	85.88	37.5	2.29	176.0	101.57	41.8	2.47
May	172.3	87.86	38.2	2.30	171.8	101.46	42.1	2.43
June	175.8	91.10	39.1	2.33	196.1	98.74	40.3	2.45
July	175.1	91.89	39.1	2.35	203.4	107.10	42.5	2.52
Aug.	181.2	96.80	40.5	2.39	203.8	105.53	42.3	2.49
Sept.	187.5	97.51	40.8	2.39	212.4	102.01	41.3	2.47
Oct.	194.5	97.27	40.7	2.39	213.3	101.18	40.8	2.48
Nov.	195.3	98.09	40.7	2.41	209.1	97.66	39.7	2.46
Dec.	198.2	102.66	41.9	2.45	208.5	101.59	40.8	2.49
Tires and Tubes								
Jan.	81.6	98.52	36.9	2.67	76.9	117.55	41.1	2.87
Feb.	78.5	93.02	36.1	2.65	76.2	118.98	41.6	2.86
Mar.	76.0	98.05	37.0	2.65	77.9	122.96	42.4	2.86
Apr.	72.1	95.67	36.1	2.65	66.0	123.98	42.9	2.90
May	70.4	99.48	37.4	2.66	52.2	126.13	42.9	2.89
June	71.2	103.63	38.1	2.72	70.7	108.93	36.8	2.96
July	71.0	106.59	38.9	2.74	79.7	128.74	43.2	2.98
Aug.	72.5	113.96	40.7	2.80	78.4	127.74	43.3	2.95
Sept.	74.1	113.40	40.5	2.80	80.5	117.56	40.4	2.91
Oct.	75.3	113.24	40.3	2.81	79.7	117.49	40.1	2.93
Nov.	76.2	115.75	40.9	2.83	79.0	112.62	38.7	2.91
Dec.	77.1	121.40	42.2	2.87	78.2	119.07	40.5	2.94
Rubber Footwear								
Jan.	17.5	74.87	39.2	1.91	17.1	78.20	39.9	1.96
Feb.	17.0	74.68	39.1	1.91	17.1	80.59	40.7	1.96
Mar.	16.7	76.61	39.9	1.92	17.4	79.79	40.3	1.98
Apr.	16.5	75.46	39.3	1.92	12.9	73.05	39.7	1.98
May	16.3	75.85	39.3	1.93	17.7	79.58	40.6	1.84
June	16.3	11.20	40.0	1.93	18.2	81.58	41.2	1.98
July	15.9	75.25	39.4	1.91	18.3	78.60	40.1	1.96
Aug.	16.4	77.18	40.2	1.92	18.4	79.17	40.6	1.95
Sept.	16.8	76.62	39.7	1.93	19.0	79.18	40.4	1.96
Oct.	17.1	77.01	39.9	1.93	19.1	79.40	39.9	1.99
Nov.	17.2	77.22	39.6	1.95	19.6	79.80	39.9	2.00
Dec.	17.1	78.01	39.8	1.96	19.4	81.40	39.9	2.04
All Other Rubber Products								
Jan.	101.8	80.94	39.1	2.07	105.1	91.27	41.3	2.21
Feb.	95.8	80.32	38.8	2.07	105.5	91.96	41.8	2.21
Mar.	91.3	79.87	38.4	2.08	106.2	93.02	41.9	2.20
Apr.	87.4	79.87	38.4	2.08	97.1	90.03	41.3	2.22
May	85.6	80.29	38.6	2.08	101.9	92.18	41.9	2.18
June	88.3	83.77	39.7	2.11	107.2	94.98	42.4	2.24
July	88.2	82.92	39.3	2.11	105.4	95.40	42.4	2.25
Aug.	92.3	86.24	40.3	2.14	107.0	93.21	41.8	2.23
Sept.	96.6	89.21	41.3	2.16	112.9	94.73	42.1	2.25
Oct.	102.1	88.78	41.1	2.16	113.5	93.38	41.5	2.25
Nov.	101.9	88.54	40.8	2.17	110.5	89.87	40.3	2.23
Dec.	104.0	92.60	41.9	2.21	110.9	92.70	41.2	2.25

Source: U. S. Department of Labor.
Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who work during, or received pay for, any part of the pay period ending nearest the 15th of the month. These employment series have been adjusted to first quarter 1954 benchmark levels indicated by data from government social insurance programs. Hours and earnings data pertain only to production and related workers.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1953	1954	1955	1956	1957	1958	1959	1960
Jan.	33.24	34.16	35.07	35.24	34.82	36.31	35.67	33.09
Feb.	33.76	35.00	35.04	36.26	34.82	35.83	35.69	33.20
Mar.	34.10	35.23	34.33	36.70	35.35	36.05	35.71	33.54
Apr.	33.85	35.22	34.23	36.43	35.43	36.00	36.05	33.20
May	34.30	35.34	34.80	36.65	35.40	36.27	36.24	....
June	34.11	35.17	34.83	36.67	35.45	36.33	36.05	....
July	34.20	35.37	34.61	35.43	35.49	36.51	34.67	....
Aug.	33.82	35.19	34.53	34.31	35.15	36.36	33.17	....
Sept.	33.69	35.46	33.85	34.35	34.74	36.00	32.99	....
Oct.	33.53	35.24	33.93	34.45	35.09	36.23	32.77	....
Nov.	33.60	34.80	34.87	34.56	36.06	36.24	32.79	....
Dec.	33.52	35.03	34.95	34.56	36.50	35.75	33.02	....
Average for Year	33.81	35.10	34.59	35.50	35.36	36.16	34.57	....

Note: The Government established a ceiling of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Production Index for the Rubber Industry

(1957 = 100)

(Based on man-hours)

	1958	1959	1960		1958	1959	1960
Jan.	110	108	117	July	125	128	...
Feb.	114	113	...	Aug.	131	120	...
Mar.	116	112	...	Sept.	136	120	...
Apr.	112	104	...	Oct.	133	115	...
May	113	105	...	Nov.	141	113	...
June	125	117	...	Dec.	140	116	...

Sales by the Rubber Industry

(in Millions of Dollars*)

	1958	1959	1960		1958	1959	1960
Jan.	448	508	530	July	478	519	...
Feb.	413	490	540	Aug.	438	492	...
Mar.	396	506	...	Sept.	464	544	...
Apr.	429	543	...	Oct.	493	555	...
May	428	524	...	Nov.	472	482	...
June	445	520	...	Dec.	518	500	...

Rubber Manufacturers' Inventories

(in Millions of Dollars*)

	1958	1959	1960		1958	1959	1960
Jan.	1,100	998	1,140	July	980	1,075	...
Feb.	1,087	1,022	1,140	Aug.	1,024	1,113	...
Mar.	1,069	1,030	...	Sept.	1,024	1,114	...
Apr.	1,047	1,015	...	Oct.	1,022	1,115	...
May	1,020	995	...	Nov.	1,018	1,120	...
June	986	1,013	...	Dec.	994	1,140	...

Source: U. S. Department of Commerce.
Notes: * Adjusted for seasonal variation.

No. 1 R.S.S.—Annual Average Prices

(New York Market—Cents per Pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1918	70	40	60.15	1939	24	14⅛	17.57
1919	57	38½	48.70	1940	24	18¾	20.10
1920	56½	16	36.30	1941	24⅞	19⅛	22.40
1921	21¼	11½	16.36	1942	22½	22½	22.50
1922	28¾	13¾	17.50	1943	22½	22½	22.50
1923	37⅛	24¼	29.45	1944	22½	22½	22.50
1924	40⅛	17¾	26.20	1945	22½	22½	22.50
1925	121	34⅜	72.46	1946	22½	22½	22.50
1926	88½	36¼	48.50	1947	25	14	20.08
1927	41¾	33	37.72	1948	25	18	21.99
1928	41¼	17	22.48	1949	19¾	15⅞	17.57
1929	26⅞	15½	20.55	1950	86	18	41.10
1930	16½	7½	11.98	1951	76	52	(a)
1931	8⅝	4¼	6.17	1952*	33	26½	29.15
1932	4¼	2½	3.49	1953	31⅞	19⅞	24.21
1933	9⅞	2⅞	5.96	1954	34½	19½	23.61
1934	15⅞	8¾	12.92	1955	52	29⅜	39.16
1935	13¾	10½	12.37	1956	45	26½	34.24
1936	23	13½	16.41	1957	37¾	26⅝	31.13
1937	26¾	14	19.39	1958	32⅝	24⅝	28.13
1938	17 1/16	10¼	14.64	1959	49	29¾	36.56

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947. (a) Free trading suspended March 31, 1951. GSA selling price ranged between 52 and 66c during balance of year. * Free trading was resumed on July 1, 1952; figures represent only July through December, 1952.

No. 1 R.S.S.—Monthly Average Prices

(New York Market—Cents per pound)

	1953	1954	1955	1956	1957	1958	1959	1960
Jan.	29.40	20.22	33.92	41.70	33.32	27.15	30.34	41.18
Feb.	27.57	19.98	34.90	33.68	30.43	26.32	30.26	39.33
Mar.	26.59	20.16	31.08	33.68	31.76	26.65	31.62	40.74
Apr.	24.66	22.06	31.75	31.75	32.23	26.44	33.72	40.35
May	25.52	21.96	31.35	29.61	32.12	25.51	36.48	....
June	24.42	23.01	34.74	30.54	32.80	26.20	34.31	....
July	23.64	24.12	40.84	33.91	32.88	27.70	35.19	....
Aug.	23.06	23.00	48.85	35.69	32.13	28.72	38.43	....
Sept.	23.06	23.00	48.27	32.64	29.94	29.49	40.22	....
Oct.	20.82	26.57	43.81	32.68	29.24	31.06	41.50	....
Nov.	20.58	28.07	44.95	35.18	27.47	32.10	45.16	....
Dec.	20.92	29.88	48.40	37.01	29.25	30.28	41.46	....
Average for Year	24.21	23.61	39.16	34.24	31.13	28.13	36.56	....

Note: (a) Free trading suspended March 31, 1951, and resumed on July 1, 1952.

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	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1951 (total)	32,153	44,612	1,677	78,442	83,405	8,765
Passenger Car.	26,729	34,226	723	61,678	65,546	6,973
Truck and Bus	5,424	10,386	954	16,764	17,859	1,791
1952 (total)	29,484	54,342	1,520	85,346	90,411	14,110
Passenger Car.	24,106	45,458	741	70,305	74,341	11,251
Truck and Bus	5,378	8,884	779	15,041	16,070	2,859
1953 (total)	37,949	55,124	1,543	94,617	96,150	15,720
Passenger Car.	33,106	45,798	809	79,713	81,455	13,044
Truck and Bus	4,843	9,326	734	14,904	14,696	2,676
1954 (total)	33,333	55,155	1,753	90,241	89,141	14,762
Passenger Car.	29,741	47,044	928	77,713	76,794	12,217
Truck and Bus	3,591	8,111	826	12,528	12,347	2,545
1955 (total)	47,374	59,246	1,879	108,499	112,178	18,778
Passenger Car.	42,574	50,189	966	93,730	97,223	15,963
Truck and Bus	4,800	9,057	912	14,769	14,955	2,815
1956 (total)	35,422	62,146	1,757	99,325	100,406	79,872
Passenger Car.	30,873	53,252	875	85,000	85,546	16,494
Truck and Bus	4,548	8,894	883	14,325	14,859	3,378
1957 (total) ...	36,765	65,150	1,733	103,649	106,940	250,536
Passenger Car.	32,725	56,603	889	90,217	93,542	210,146
Truck and Bus	4,053	8,546	846	13,432	13,398	40,384
1958 (total)	26,783	70,797	1,348	98,928	96,563	20,939
Passenger Car.	23,408	61,570	717	85,696	83,636	17,778
Truck and Bus	3,375	9,226	631	13,232	12,927	3,161
1959 (total)	34,163	76,812	1,430	112,405	117,875	26,933
Passenger Car..	29,746	66,797	786	97,329	102,637	23,578
Truck and Bus	4,417	10,015	644	15,076	15,238	3,355
1959:						
Apr. (total)	3,594	7,297	109	10,999	8,025	20,872
Passenger Car.	3,115	6,390	65	9,569	6,986	17,597
Truck and Bus	479	907	44	1,430	1,039	3,276
May (total)	3,291	6,356	79	9,726	7,796	18,727
Passenger Car.	2,848	5,617	38	8,504	6,853	15,721
Truck and Bus	442	738	41	1,222	843	3,006
June (total)	3,392	6,756	90	10,237	10,294	19,088
Passenger Car.	2,903	5,936	46	8,886	9,022	16,134
Truck and Bus	488	820	44	1,352	1,272	2,954
July (total)	3,588	6,832	112	10,532	11,223	19,877
Passenger Car.	3,188	5,988	65	9,242	9,857	16,853
Truck and Bus	340	844	47	1,290	1,366	3,023
Aug. (total)	1,249	6,595	114	7,957	9,683	21,730
Passenger Car.	973	5,721	67	6,761	8,458	18,677
Truck and Bus	276	874	46	1,196	1,225	3,054
Sept. (total)	2,345	6,819	135	9,298	10,103	22,542
Passenger Car.	1,923	5,850	77	7,850	8,804	19,636
Truck and Bus	422	969	58	1,448	1,299	2,906
Oct. (total)	2,966	7,166	136	10,269	10,884	23,151
Passenger Car.	2,628	6,015	79	8,722	9,374	20,287
Truck and Bus	338	1,151	57	1,547	1,510	2,864
Nov. (total)	1,440	4,898	120	6,458	8,347	25,133
Passenger Car..	1,252	4,161	64	5,476	7,088	21,996
Truck and Bus	189	737	56	982	1,259	3,137
Dec. (total)	3,197	4,565	180	7,942	9,645	26,933
Passenger Car..	2,912	3,826	105	6,844	8,344	23,578
Truck and Bus	285	739	75	1,099	1,301	3,355
1960:						
Jan. (total)	4,333	6,823	156	11,322	10,325	25,943
Passenger Car.	3,912	6,006	111	10,030	9,011	22,567
Truck and Bus	421	826	45	1,292	1,315	3,376

Source: The Rubber Manufacturers Association, Inc.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1940	3,692,328	721,637	4,413,965	1950	6,665,836	1,332,263	7,998,099
1941	3,744,500	875,381	4,619,681	1951	5,337,729	1,420,432	6,758,161
1942	220,814	133,083	353,897	1952	4,320,794	1,212,790	5,533,584
1943	0	4,501	4,501	1953	6,121,787	1,202,196	7,323,983
1944	0	124,819	124,819	1954	5,558,897	1,038,045	6,596,942
1945	83,792	313,643	397,435	1955	7,920,186	1,245,018	9,165,204
1946	2,148,699	930,760	3,079,429	1956	5,816,109	1,100,417	6,916,526
1947	3,558,178	1,220,634	4,778,812	1957	6,113,344	1,097,006	7,210,350
1948	3,909,270	1,363,856	5,132,090	1958	4,257,812	874,278	5,132,090
1949	5,108,841	1,123,736	6,232,577	1959	5,591,243	1,134,858	6,726,101
1959:							
Jan.	539,451	96,044	635,495	July	548,524	114,687	663,211
Feb.	476,977	99,973	576,950	Aug.	255,831	60,147	315,978
Mar.	575,012	111,355	686,367	Sept.	229,410	79,573	308,983
Apr.	585,789	116,910	702,699	Oct.	537,159	94,993	632,152
May	545,001	114,995	659,996	Nov.	267,829	53,968	321,797
June	554,878	119,544	674,422	Dec.	475,382	72,669	548,051
1960:							
Jan.	676,712	115,268	791,980	July	.....	.....	.....
Feb.	656,579	125,938	782,517	Aug.	.....	.....	.....
Mar.	659,730	131,169	780,899	Sept.	.....	.....	.....
Apr.	.....	.....	.....	Oct.	.....	.....	.....
May	.....	.....	.....	Nov.	.....	.....	.....
June	.....	.....	.....	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Automotive Inner Tubes

(Thousands of Units)

	Shipments					
Year	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	41,240	42,671	811	84,723	80,179	...
1951	32,151	32,284	1,071	65,507	67,249	10,094
1952	29,451	32,985	1,014	63,449	65,073	12,036
1953	37,957	36,072	878	74,907	74,425	11,874
1954	25,071	35,576	945	61,593	48,279	9,519
1955	5,001	33,387	1,001	39,389	35,900	6,833
1956	3,100	32,358	1,040	36,498	34,405	6,109
1957	3,046	35,687	1,076	39,806	39,774	80,077
1958	2,678	37,872	870	41,420	41,266	8,602
1959	3,624	41,522	891	46,037	46,059	10,536
1959:						
June	392	3,421	59	3,872	3,683	7,000
July	317	3,564	66	3,948	4,345	7,560
Aug.	210	3,306	77	3,592	3,716	7,848
Sept.	347	3,258	88	3,693	4,065	8,334
Oct.	265	3,571	79	3,915	4,391	9,088
Nov.	163	2,867	67	3,097	3,756	9,918
Dec.	240	2,793	102	3,135	3,612	10,536
1960:						
Jan.	365	4,964	62	5,391	3,899	8,924

Source: The Rubber Manufacturers Association, Inc.

Vinyl and Vinyl Copolymer Resins—Sales

(Thousands of Pounds—Resin Content)

	Polyvinyl Chloride and Copolymer Resins						All Other Vinyl Resins		
	Film	Sheeting	Molding & Extrusion	Textile & Paper Treating	Flooring	Protective Coatings	All Other Uses	Adhesives	All Other Uses	Grand Total
1953	63,691	62,385	129,215	52,353	22,152	22,823	27,790	22,411	77,478	480,299
1954	69,943	56,588	147,284	49,546	34,890	23,676	35,148	26,609	74,090	517,773
1955	83,276	51,424	183,736	64,223	56,357	27,439	53,868	31,853	105,644	657,821
1956	78,063	55,598	206,726	62,931	65,384	28,522	71,859	36,565	115,151	720,799
1957	90,543	56,344	216,517	66,392	81,357	31,519	50,637	41,665	113,396	748,370
1958	72,404	67,594	214,701	63,050	113,583	26,913	68,307	52,904	117,752	801,208
1959	85,136	125,639	304,711	64,703	151,840	31,371	94,418	57,599	159,528	1,074,945
1959:										
Aug.	7,074	10,750	25,069	5,683	12,867	2,602	7,940	4,915	12,379	89,279
Sept.	7,112	11,275	28,106	6,387	11,939	2,904	7,644	5,167	11,540	92,074
Oct.	8,638	12,604	30,838	4,898	14,212	2,927	8,615	5,716	13,422	101,870
Nov.	7,962	11,598	26,409	3,968	12,801	2,095	7,242	4,786	13,145	90,006
Dec.	7,360	11,923	22,604	4,151	11,482	2,443	9,886	4,705	12,215	86,769
1960:										
Jan.	8,846	10,244	21,253	5,012	12,989	2,715	8,151	4,551	12,433	86,194
Feb.	9,044	10,382	24,234	5,019	13,722	2,602	7,585	4,811	13,849	91,248

Source: Chemical Division, U. S. Tariff Commission.

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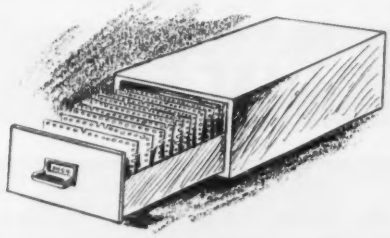

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Various Compounding Materials Consumed by the Rubber Industry

Material	1951	1952	1953	1954	1955	1956	1957
Antimony, Primary							
Short tons	19e	66e	20e	49e	78	156	284
% of total	.001	.004	.001	.004	.006	.010	.024
Asphalt: [a]							
Short tons	21,414	33,288	.....	.....	.. ..	.....	.....
% of total	0.3	0.4	.....	.....	.....	.....	.....
Barite (Barytes):							
Short tons	15,000	18,000	21,000	20,000	25,104	22,101	21,782
% of total	2.13	2.0	2.0	2.0	2.0	2.0	1.0
Carbon Black:							
Short tons	530,614	537,273	566,797	511,813	643,430	622,325	635,781
% of total	93.9	93.1	94.4	93.5	93.5	95.5	95.5
Clay, Kaolin:							
Short tons	231,331	240,982	241,052	247,431	257,223	268,157	301,185
% of total	12.7	13.2	12.8	13.2	11.9	12.0	14.0
Clay, Fire & Stoneware:							
Short tons	.....	9,322	18,475	8,781	2,928	.. ..	.....
% of total	.....	0.1	.2	.1	.2	.....	.....
Lime:							
Short tons	1,126	2,000	1,631	1,555	1,465	2,487	2,799
% of total	(d)	(d)	(d)	(d)	(d)	(d)	(d)
Litharge:							
Short tons	2,641	2,109	2,230	1,768	1,947	2,266	1,898
% of total	1.1	1.5	1.4	1.3	1.3	1.7	1.4
Lithopone:							
Short tons	3,295	1,523	1,723	1,701	2,163	2,000e	....
% of total	3.2	2.5	3.3	3.9	5.0	5.0	....
Mica, Ground:							
Short tons	6,551	5,126	5,668	5,021	7,339	7,021	8,579
% of total	9.0	7.0	7.8	6.3	6.9	8.0	9.0
Sulfur:							
Short tons	84,000	84,000	89,600	84,000	89,600	89,600	89,600e
% of total	1.4	1.4	1.4	1.3	1.2	1.1	1.1
Talc: [b]							
Short tons	70,970	64,476	61,408	58,139	38,309	30,253	28,532
% of total	11.2	10.9	10.0	9.7	5.4	5.0	6.0
Zinc Oxide:							
Short tons	71,507	72,774	78,439	71,058	86,677	80,459	81,745
% of total	48.4	51.2	52.7	50.7	51.5	51.9	54.0

Source: U. S. Bureau of Mines.
Notes: (a) Solid and semi-solid products of less than 200 penetration (b) Includes prophyllite and ground soapstone. (c) Does not include precipitated antimony sulfide as in previous years. (d) Negligible. (e) Estimated.

Reclaimed Rubber
(Including Natural and Synthetic)
(All Quantities in Long Tons)

Year	New Supply	Consumption: Tons	Consumption: % to Crude [a]	Exports	Stocks On Hand at End of Period
1941	274,202	251,231	32.2	13.851	41,750
1942	286.00. [b]	254,820	64.6	30,405	42,532
1943	304.058 [c]	291,082	59 6	15,678	46,201
1944	260.631 [d]	251,083	35.3	11,800	43,832
1945	243.309	241.036	30.2	13.413	28,155
1946	295,612	275,410	26.5	14.461	33.666
1947	291,395	288.395	24.8	14,556	35.943
1948	266,861	261,213	24.4	11,428	32.630
1949	224,029	226.679	22.5	10.637	28.263
1950	314,008	303,733	24.1	11,740	35.708
1951	366.700	346.121	26.6	14,722	45.082
1952	274,981	280.002	22.2	11,180	30.664
1953	298,336	285,050	21.3	11,597	32,319
1954	258,101	249.049	20.2	10.232	30.746
1955	326,649	312,781	20.4	13.988	31,498
1956	287,220	270,547	18.8	13.832	34,969
1957	271.647	267.352	18.2	13,021	29.323
1958	259,809	248,156	18.2	11,362	29,063
1959	303,479	286,410	20.0	11,757	27,738
1959:					
Jan.	25,790	25,002	17.9	1,157	27,157
Feb.	25,290	24,471	18.2	1,041	27,504
Mar.	29,327	27,869	18.8	1,375	27,582
Apr.	21,672	22,380	18.5	1,225	25,131
May	19,441	20,496	18.1	980	23,554
June	26,169	24,998	17.9	1,054	23,448
July	27,884	23,942	16.9	1,236	25,949
Aug.	25,276	22,914	16.6	879	26,165
Sept.	28,130	25,137	17.2	937	27,384
Oct.	28,255	26,022	17.6	964	27,393
Nov.	22,525	20,217	16.1	909	28,526
Dec.	23,720	22,962	17.4	1,055	27,738
1960:					
Jan.	26,442	26,112	18.5	...	28,636

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Cotton, Rayon and Nylon Tire Fabrics
(In Thousands of Pounds)

	Production: Rayon Tire Cord Not Woven	Production: Rayon Tire Cord Woven	Production: Cotton and Nylon Cord & Fabric [a]	Production: Chafer Fabrics (all fibers)	Production: Total Tire Cord and Fabric	Stocks [b]: Cotton and Nylon Cord & Fabric	Stocks [b]: Rayon Cord and Fabric
1958:							
Jan.-Mar.	8,372	56,522	25,647	7,367	92,924	11,255	33,913
Apr.-June	.....	.....	30,745	6,020	80,533	11,274	26,327
July-Sept.	.....	.....	31,371	6,467	91,984	11,229	26,428
Oct.-Dec.	.....	.....	34,858	8,466	107,532	12,251	25,936
Total	8,372	56,522	122,621	28,320	372,973	46,009	112,604
1959							
Jan.-Mar.	77,307	77,307	41,565	9,163	122,661	14,025	22,093
Apr.-June	76,265	76,265	37,102	7,699	116,965	16,811	31,094
July-Sept.	76,671	76,671	39,863	8,318	119,748	14,040	35,152
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: Bureau of the Census, U. S. Department of Commerce.
Notes: (a) Combined to avoid disclosing figures for individual companies. (b) At end of period.

Gasoline Consumption
(In Thousands of Barrels of 42 Gallons)

	1954	1955	1956	1957	1958	1959	1960
Jan.	89,634	96,397	100,642	109,295	107,281	114,720	112,365
Feb.	86,206	88,464	98,088	96,694	95,516	99,759	.....
Mar.	101,549	105,684	112,412	113,166	108,914	118,995	.....
Apr.	103,866	111,116	113,034	115,820	118,477	124,917	.....
May	104,418	115,707	123,560	124,325	125,137	127,049	.....
June	113,037	120,710	126,833	121,598	125,444	133,695	.....
July	112,231	115,653	120,708	130,251	130,903	137,141	.....
Aug.	110,223	121,816	125,847	128,808	129,925	132,875	.....
Sept.	104,706	113,379	111,574	113,567	120,389	130,264	.....
Oct.	105,607	112,558	119,204	119,334	125,097	120,858	.....
Nov.	102,393	109,212	112,113	107,705	110,587	116,056	.....
Dec.	104,258	111,034	108,096	112,691	120,305	123,587	.....
Total	1,238,346	1,321,730	1,372,116	1,393,254	1,417,975	1,479,907	.....

Source: U. S. Bureau of Mines.

U. S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.
(All Quantities in Long Tons)

Year	Balata: Tons	Balata: Value	Jelutong: Tons	Jelutong: Value	Gutta-Percha & Other Guttas: Tons	Gutta-Percha & Other Guttas: Value
1945	1,361	907,253	....	.....	36	21,970
1946	2,281	2,233,065	304	256,169	423	458,064
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1948	1,195	805,078	3,401	2,377,765	423	542,788
1949	1,391	814,554	1,043	834,978	197	189,021
1950	2,117	1,589,885	1,789	1,515,162	541	745,418
1951	2,452	1,973,271	1,669	2,608,359	383	430,539
1952	988	762,994	1,636	2,094,983	282	385,890
1953	1,619	966,248	1,027	1,166,837	235	303,116
1954	949	504,065	2,196	2,624,926	417	511,055
1955	1,022	967,369	1,679	1,731,821	284	318,115
1956	1,396	1,111,165	1,851	1,909,447	290	309,615
1957	1,037	670,821	1,680	1,942,067	230	270,487
1958	745	536,820	1,501	1,698,840	157	224,400
1959	1,512	1,350,843	1,296	1,608,986	268	311,178
1959:						
July	82	76,165	113	107,280	28	34,629
Aug.	54	23,923	123	139,588	40	39,254
Sept.	256	215,453	91	107,626	10	17,230
Oct.	188	254,838	107	187,721	16	13,020
Nov.	254	204,360	27	28,997	20	20,932
Dec.	150	162,680	105	121,819	10	16,710

Source: U. S. Department of Commerce.

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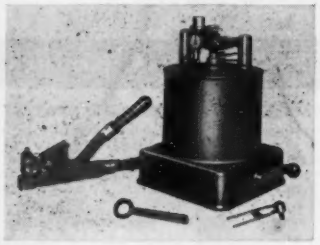

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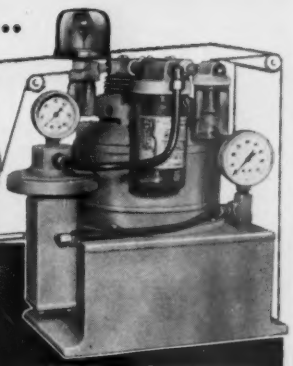

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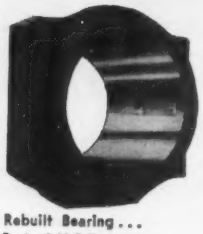

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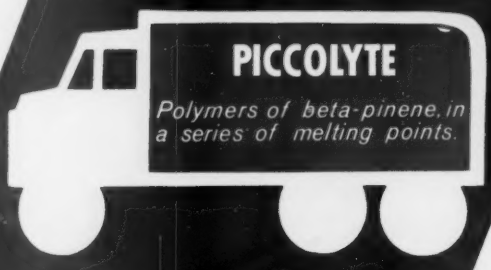

Many compounders have found PICCO Resins to be the answer to their specific problems. There are as many PICCO applications as there are compounds. They are commonly used to plasticize, extend, disperse, stiffen, reinforce or tackify rubber and plastics.

Consult your Harwick representative for information on the PICCO Resins which will add desirable qualities to your product.

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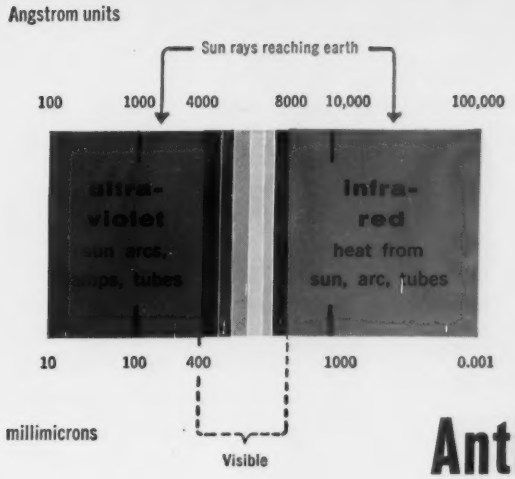

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